Ocean and Coastal Management 173 (2019) 36–51

Contents lists available at ScienceDirect

Ocean and Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Adaptive capacity and social-ecological resilience of coastal areas: A systematic review

Hakna Ferro-Azcona[a,b], Alejandro Espinoza-Tenorio[c], Rafael Calderón-Contreras[d], Victoria C. Ramenzoni[e], Maria de las Mercedes Gómez País[f], Maria Azahara Mesa-Jurado[a,*]

[a] El Colegio de la Frontera Sur, Unidad Villahermosa. Carretera Villahermosa-Reforma km 15.5, Ra Guineo, 2ª sección, 86280, Villahermosa, Tabasco, Mexico
[b] Centro Nacional de Áreas Protegidas, Calle 18A, No. 4114, Miramar, C.P. 11300, Playa, La Habana, Cuba
[c] El Colegio de la Frontera Sur, Unidad Campeche. Av. Rancho Polígono 2-A, Col. Ciudad Industrial, Lerma, 24500, Campeche, Mexico
[d] Universidad Autónoma Metropolitana, Unidad Cuajimalpa. Avenida Vasco de Quiroga 4871, Santa Fe Cuajimalpa, 05370, Ciudad de México, Mexico
[e] Climate Institute, Rutgers University, Environmental and Natural Resources Sciences Building 14 College Farm Road, New Brunswick, NJ 08901-8551, United States
[f] Ministerio de Ciencia, Tecnología y Medio Ambiente. Calle Línea No.8 entre N y O, Vedado, Plaza de la Revolución, 10400, La Habana, Cuba

ARTICLE INFO

Keywords:
Protected areas
Adaptation
Vulnerability
Global change
Climate change
Marine and coastal areas

ABSTRACT

Establishing protected areas constitutes one of the main strategies for the conservation of marine and coastal ecosystems. Increasing risks associated with environmental change along with highly degraded coastal ecosystems encompass complex management challenges for the long-term sustainability of these landscapes. This article aims to explore the role of protected areas in past and ongoing community adaptation to the compounded effects of climatic and anthropogenic change. A literature review of published articles is conducted through systematic queries of the bibliographic database Web of Sciences, and by comparing adaptation and social-ecological resilience processes within and out of coastal protected areas. Findings underscore the absence of specific studies that target these topics inside protected areas, highlighting a geographic bias towards research largely carried out in developed countries. Results also indicate the current need for management practices within protected areas to adopt more participatory, comprehensive, and flexible approaches. Protected areas not only promote the conservation and provision of ecosystem services but are also key in building coastal communities' adaptive capacity and resilience in face of future scenarios.

1. Introduction

The International Union for the Conservation of Nature (IUCN) refers to Protected Areas (PAs) as "clearly defined geographic spaces, recognized and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008). Originally, PAs were conceived as management tools to counteract the loss of biological diversity. PAs rely on planning and organizing a territory, establishing diverse uses and access regimes with the primary objectives of habitat conservation and restoration of key ecological services (Lopoukhine et al., 2012; Pinkus-Rendón et al., 2018; Wenzel et al., 2013). In recent years, PAs are being recognized not only for their contribution to conservation but as one of the main instruments to promote adaptation and social-ecological system (SES) resilience (Cinner et al., 2009; Dudley et al., 2009; IPCC, 2014; Roberts et al., 2017; Uribe Botero, 2015). This change has partly been the product of a reconceptualization of the role of human communities in natural resources management by the incorporation of local stakeholders in planning and management through more socially inclusive environmental policies (Berkes, 2015; Bockstael et al., 2016; Brody et al., 2013; Brosius et al., 2005; Few et al., 2007; Gasalla, 2011; Rivera et al., 2014). It is also a result of in-depth studies on SES resilience, as well as on the intervening processes of adaptation (anticipation, response, and recovery) to environmental and extreme events and anthropogenic actions (Egyir et al., 2015; Felicetti, 2016; Potts et al., 2013). Several authors have investigated the role played by institutions related to environmental management in order to promote adaptive capacity (AC) of SES in face of climate change and anthropogenic risks (Agrawal, 2008; Ahmadvand et al., 2009; de Lange et al., 2016; Engle and Lemos, 2010; Jones et al., 2018, 2017; Oldekop et al., 2016; Zafra-Calvo et al., 2017). Although PAs constitute physical-geographical spaces dedicated to the conservation of biodiversity, they have characteristics that enable them to be considered as institutions (Villalobos, 2000).

* Corresponding author.
E-mail address: mmesa@ecosur.mx (M.A. Mesa-Jurado).

https://doi.org/10.1016/j.ocecoaman.2019.01.005
Received 14 September 2018; Received in revised form 25 December 2018; Accepted 20 January 2019
Available online 27 February 2019
0964-5691/ © 2019 Elsevier Ltd. All rights reserved.

Coastal areas play an important role in adaptation, as they lessen the impact of meteorological phenomena (Roberts et al., 2017; Waite et al., 2014; Yáñez-Arancibia and Day, 2004) and contribute to the resilience of coastal and marine populations, among other benefits (Hopkins et al., 2016; Micheli et al., 2012). Even so, these areas show high vulnerability to the effects of environmental change (Bruno et al., 2018; Hagerman et al., 2010; Knapp et al., 2014; Lewis, 2013; Martínez and Aránguiz, 2016; Mehvar et al., 2018; Yuan et al., 2015) and to other types of stressors derived from human development (Aswani et al., 2017; Teng et al., 2016). It is important to highlight how important these areas are in terms of the ecological, economic, social and cultural benefits they provide (Arkema et al., 2015; Barbier et al., 2011; Littles et al., 2018; Mehvar et al., 2018; Millennium Ecosystem Assessment, 2005; Sausner and Webster, 2016); at the same time they are home to a significant proportion of the world's population, a trend that is likely to increase in the coming decades (Bunce et al., 2010; Kim et al., 2014; Rasheed et al., 2016). In this context, the number of policy interventions addressing the reduction of vulnerability in coastal communities has also increased (Cinner et al., 2012; Portman, 2018; Serrao-Neumann et al., 2013; Yoo et al., 2011, 2010), as have studies in the fields of human ecology, ecological economics and rural sociology that address the adaptation of human communities established in coastal zones (Adger, 2000; Engle, 2011; Kotzee and Reyers, 2016; Moreno-Sánchez and Maldonado, 2013; Thathsarani and Gunaratne, 2018). Marine and coastal protected areas are designed to protect intertidal or subtidal terrain, along with its overlying water and associated flora, fauna, historical and cultural features (Kelleher, 1999). These particular PAs are fast becoming a mainstream management tool for conserving biodiversity in virtually all the world's oceans through the promotion and recovery of overexploited species and the protection of marine and coastal ecosystems (Agardy et al., 2003; Micheli et al., 2012; Oceana, 2011).

The key question that this article will address is whether the existing literature related to the above-mentioned topics reflects the role of coastal protected areas in adaptation processes to climate change and associated risks as well as risks derived from anthropic activities. In this context, the main goal of the present paper is to systematically review the research carried out within and outside protected areas, in order to better understand the adaptation processes that take place in coastal communities. To this end, the study aimed at elaborating on four specific objectives: i) Examine the temporal and spatial distribution of studies on social-ecological resilience and adaptive capacity (AC), ii) Identify the objectives or purposes of each research paper, iii) Determine if coastal protected areas affect the adaptation of communities according to what is published in the scientific literature, iv) Determine the spatial and temporal distribution of stressors that impact the regions studied. These results not only will assist the general knowledge about adaptation processes that take place in coastal areas, but will also guide the planning of future evaluations that cover the knowledge gaps detected around this topic.

2. Adaptation as concept

The concept of ecological resilience introduced by Holling (1973), has been broadened by scholars from different disciplines in order to combine ecological and social systems. According to Walker et al. (2004), resilience is the ability of a SES to absorb disturbances and reorganize itself during the process of change, so that it essentially maintains the same functions, structures, identity, and feedbacks. Resilience, as defined by these authors, can be considered as the synthesis of the definitions proposed by Gunderson and Holling (2002) and the operational definition by Carpenter et al. (2001). Specifically, this notion refers to the amount of disturbances a system can endure while maintaining its original functions and controls (Gunderson and Holling, 2002) as well as the extent to which a SES is capable of self-organization, learning and adaptation (Calderón-Contreras, 2016, 2010; Carpenter et al., 2001).

These definitions of resilience are based on the characterization of a system that is not in a static equilibrium, but presupposes the integration and dynamic interaction of its components and processes during its operation. This perspective implies defining the SES as a Complex Adaptive System (CAS) (Baggio et al., 2015; Baggio and Calderón-Contreras, 2017; Baggio, 2011; Folke, 2006; Levin et al., 2013). Within this perspective, human beings are an active and integral part of the ecological system, as much as the ecological system is an active and integral part of the social system through multiple spatial and temporal scales (Baggio et al., 2015; Boyd and Folke, 2011; Chen et al., 2017; Gunderson and Holling, 2002; Ostrom, 2009). The resilience of a SES is linked to the levels of dependency that communities have on the coastal ecosystems (Adger, 2000; Marshall et al., 2010; Mozumder et al., 2018). The interaction between these systems leads to the formation of a social-ecological system that involves absorption, adaptation, learning and self-organization that allows it to persist in coping with various stressors (Berkes, 2017; Folke, 2006; Folke et al., 2010).

Adaptive capacity is defined as the ability to live and reproduce considering a certain range of environmental contingencies (Gallopin, 2006). Adaptive capacity is not a generic property; it refers to a certain environment or range of environments, to which different organisms, populations, or species are adapted. This concept has also been approached from the context of risk and vulnerability to hazards (Freduah et al., 2018; Mendoza et al., 2014; Moreno and Becken, 2009; Mustafa, 1998; Pruneau et al., 2013; Yemawnade et al., 2016) and is assumed as the ability of a system to respond to changes through learning, risk and impact management, the accumulation of new knowledge and the development of effective management plans (Henly-Shepard et al., 2015; Kerry et al., 2012; Marshall et al., 2010; Sandanam et al., 2018). In adaptation literature there is a need to increase empirical research in order to better describe what governance mechanisms affect AC and what their interrelationships are like (Engle and Lemos, 2010; Grecksch, 2013; Gupta et al., 2016; Van den Brink et al., 2014). The AC represents the characteristics of the social-ecological system that support, through certain actions, communities so that they can respond to environmental or anthropic impacts (Gupta et al., 2010). Such capacity depends on the context and geographical, temporal, social, and individual conditions where the SES is located (Alberini et al., 2006; Smit and Pilifosova, 2003; Tolentino-Arévalo et al., 2018).

Adaptive capacity research has adopted, as a conceptual starting point, the analysis of key factors that define it (Brooks et al., 2005; IPCC, 2001; Keskitalo et al., 2011; Warrick et al., 2017). Among the determining factors identified in the literature are: income, technology, policies and institutions, accessible information and knowledge, education and access to external capital (Kuruppu and Liverman, 2011; Larson et al., 2013; Nguyen et al., 2015; Smit and Wandel, 2006; Tapsuwan and Rongrongmuang, 2015; Yohe and Tol, 2002), infrastructure and equity (Below et al., 2012; Engle, 2011; Smit and Pilifosova, 2003). Some of these attributes focus on the local dimensions, while others reflect the socio-economic and political conditions (Smit and Pilifosova, 2003).

2.1. Contrasting social-ecological resilience and adaptive capacity

In this paper, resilience and adaptive capacity are considered as two distinct but interrelated notions. Both concepts describe certain behaviors through which systems respond dynamically to changes (Lambeth, 2016; Nelson, 2011). On the one hand, adaptive capacity represents a property of social-ecological resilience that facilitates the transformations of a system when its current state is unsustainable (Folke, 2006; Smith and Frankenberger, 2018), whereas resilience includes adaptation and its capabilities, as fundamental features to keep operational over time (Mulrennan and Bussières, 2018; Nelson, 2011; Norris et al., 2008). Nonetheless, this interrelation between the terms has been criticized. For example, social-ecological resilience has been

questioned for its applicability (resilience of what? And why?) (Carpenter et al., 2001); and even to its concrete interference (for whom? And when?) (Biggs et al., 2015).

One way to resolve this ambiguity lies in understanding the impact, or stressor, to which the system responds. The identification of multiple stress factors not only has great importance in the visualization of the different processes that influence the increasing climate and vulnerability variations, but also allows understanding of what kind of adaptive response a community can formulate. This is key to understanding if adaptive capacity is a response triggered by a risk or a specific impact, or if it is an inherent attribute to the resilience of the system.

This study identified the two most common sources of impact that SES face in coastal areas. On the one hand, a large number of studies evidence the increase in magnitude and frequency of climate change and its effects that threaten the adaptive capacity of human communities (Awal et al., 2016; Granderson, 2017; IPCC, 2001). On the other hand, the rapid increase in population density in coastal areas, as well as the influence of other events unrelated to climate change, are considered as other types of risks (Bennett et al., 2015a). The source of these events can come from diverse sources, such as environmental, social, economic or political (García, 2004; Kirch et al., 2017; Razafindrabe et al., 2014).

3. Materials and methods

In order to explore the role of protected areas in community adaptation processes, a multi-stage systematic review process of specialized literature was carried out in the areas of climate change, socio-environmental sciences, natural resources administration or management, and disciplines associated with conservation and ecological restoration. For this review, the ISI Web of Knowledge database was employed to find peer-reviewed scientific literature in English and in Spanish. The selection of this database responds to the fact that the algorithms executed in the search site allow to specify the consideration of the abstract, title, and keywords during the search process. To increase the number of studies, truncation of the extent of terms was made by using superscript asterisks. The search included in its syntax combinations of the keywords: adaptive capac*, social-ecological resilie*, socio-ecological resilie*, communit* resilie* and coast* to specify the concepts and region. During a second step, the terms coast* protected area* and protected area* were added to focus on these specific areas. In the second stage, documents that appeared as duplicates or published as part of editorials, conferences and book chapters were excluded (Fig. 1).

In the third stage of the search process, abstracts were checked for their relevance to define the scope according to the following criteria: 1) referral to coastal habitats; 2) correspondence to case studies exclusively and 3) contribution or original input through their findings and discussion. Appendix 1 provides a listing of the selected studies with geographical and focused theme (social-ecological resilience, adaptive capacity to risk or climate change) details, specifying if the research was carried out within a protected area.

A deeper analysis of the methodology, results and discussion sections were reviewed from the selected studies. After carefully studying each paper, information about concepts used (AC for risk, AC for climate change or Resilience), theoretical background, case study location (within PA or not PA), methods employed, and stressors analyzed were compiled in a database.

To establish the type of contribution of each article, the objectives or purposes mentioned explicitly by each paper were considered. In a first group labeled as “Policy-making formulation” were those studies which, from their own findings, show implication for designing policies or public programs oriented to improve any aspects of adaptive capacity or resilience to climate change or other stressors through different geographical, social and political contexts. A second group labeled “Measurement” was included, which encompassed those proposals focused on procedures for measuring or operationalizing the adaptive capacity to climate change and risk, and social-ecological resilience.

The studies were filtered with regard to metadata variables, namely journal, authors, concept (i.e. social-ecological resilience, adaptive capacity to risk or adaptive capacity to climate change), study area location and stressors. The term *stressor* refers to an increase in the influence of an external factor on the conditions of a SES such as extreme weather events and government policies (Turner et al., 2003). This can result in adverse impacts that in turn lead to changes at various functioning scales of the system (Bennett et al., 2015a). Because the term stressor varies in its definition depending on the temporal and spatial scale in which it is contemplated, as well as according to its nature (social, ecological, etc), a reclassification was proposed. To this end, the “multiple stressor factors”, approach proposed by Bennett et al. (2015a,b), was adopted. These other environmental factors may be linked to climate and environmental change; however, this analysis separates these categories for logistical reasons. In the case of studies

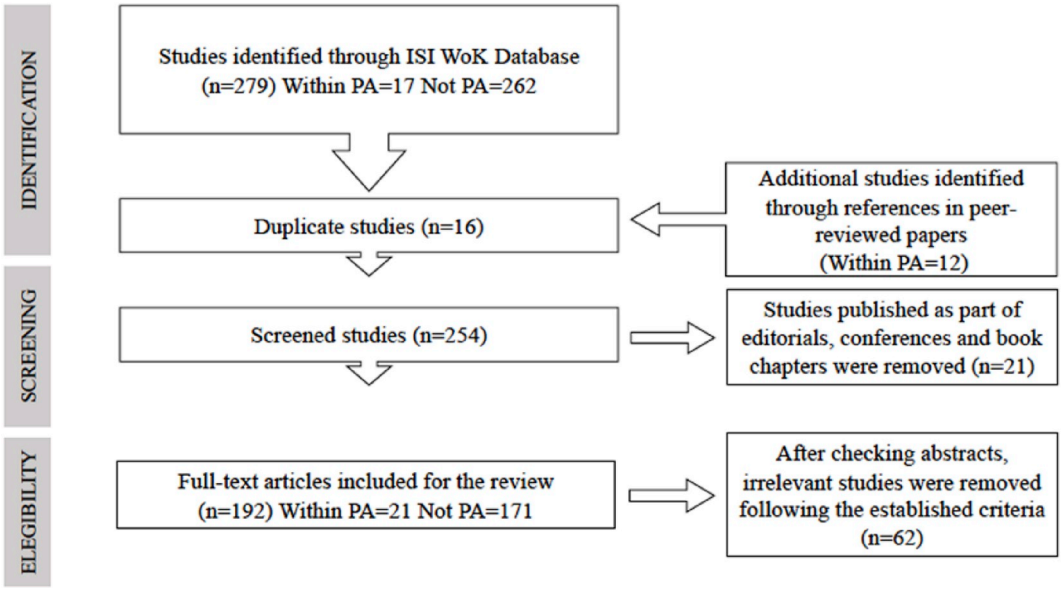


Fig. 1. Systematic review process including number of papers (n) reviewed in each stage based on Moher et al. (2009)'s flow diagram.

that propose measurement of adaptive capacity or resilience, other variables as methodology applied, data sources, instruments for collecting information and the determinants of adaptive capacity or resilience were also filtered.

Aggregative criteria were followed in the selection of studies (Booth et al., 2012) to establish, among other goals, whether a relationship between resilience and adaptive capacity is observed on studies dealing with protected areas. In this sense it is important to highlight that using the coordinating conjunction "and" between the terms adaptation and resilience in the search syntax reduces the total number of results obtained, making it difficult to detect the association between the PAs and the search terms. However, we demonstrated that using the conjunction did not critically affect the conclusions of the reviewing process.

The coordinating conjunction "and" also works as a filter because notions of adaptation or resilience are widely used in fields such as clinical psychology or physiology that are not directly relevant to answer the question asked in this study. Second, the frequent co-occurrence observed in the mention of the terms of resilience and adaptation in social-ecological studies suggests that there are few cases where both concepts are not included due to their degree of semantic proximity (Maldonado and Moreno-Sánchez, 2014; Nelson et al., 2007). Finally, it should be noted that the PAs initially defined as *marine* were considered in the analysis as long as they included coastal zones in their jurisdiction (Oceana, 2011).

4. Results

4.1. Stressors on coastal areas

The influence of numerous stressors that impact ecosystems and human communities are identified for coastal areas. They cause changes at spatial and temporal levels. Biophysical stressors are the main to impact ecosystems and communities analyzed in these papers (Table 1). Among the biophysical stressors identified are climate change (for example, sea level rise) and others classified as other environmental factors such as cyclones, hurricanes, coastal erosion, coastal rains, tsunamis, floods, storms, droughts, earthquakes, typhoons, as well as environmental changes produced by El Niño, landslides, salinity and invasive species.

Among the socio-economic stressors are those related to demographic factors (urbanization and population growth); economic (overfishing, overexploitation and scarcity of natural resources, decrease in fishing prices, poverty, economic exclusion, government subsidy programs); infrastructure and technology (coastal development, dam construction, cruise tourism, renewable energy sources, aquaculture, agriculture, oil spill); and governance and policy (changes in the zoning of protected areas, establishment of protected areas, natural resource management systems, government policies, impacts of biodiversity conservation projects, land use change, fisheries capture programs). The development of anthropic actions in coastal regions such as land use change, increased urbanization and establishment of natural resource management systems that lead to vulnerabilities in human communities are analyzed in the investigations we examined (Bennett et al., 2015a; Castilla et al., 2016; Chu et al., 2017; Frick-Trzebitzky, 2017; Hicks et al., 2009; Levine and Richmond, 2014; Preston et al., 2009; Rasheed et al., 2016; Wang et al., 2013). As a result of this situation, the environmental status of coastal ecosystems in some regions such as the Western Indian Ocean, Northern Andaman coast, or Nigeria's coastal region is seriously deteriorated (Adelekan and Fregene, 2015; Bennett et al., 2015a,b; Bennett et al., 2014; Cinner et al., 2012).

Table 1
Studies addressing biophysical and socioeconomic stressors in coastal areas.

Stressors	Classification	Number of studies	%
Biophysical	Other climatic factors (e.g. cyclones, hurricanes and others events)	74	38.54
	Climate change	69	35.94
Subtotal		143	**74.48**
Socioeconomic	Governance and policies	17	8.85
	Economics	15	7.81
	Infrastructure and technology	14	7.29
	Demographic	3	1.56
Subtotal		49	**25.52**
Total		192	100

4.1.1. Climate change as coastal impact

In relation to the anticipation of future scenarios associated with climate change, some of the analyzed papers incorporate the set of projections formulated by the IPCC (19.27%). The impacts considered for the future include mean sea level rise, waves, increases in precipitation, and occurrence of droughts. Australia represents one of the developed nations with the highest number of publications as well as one of the most vulnerable countries as a result of climate change and other effects (McNamara et al., 2017; Metcalf et al., 2015; Nursey-Bray et al., 2013; Petheram et al., 2015; Richards et al., 2016; Tull et al., 2016). Similar studies are observed in developing countries such as Kenya, Tanzania, Seychelles, Mauritius, and Madagascar, Mozambique, South Africa and Papua New Guinea (Celliers et al., 2013; Cinner et al., 2012; Kithiia and Dowling, 2010; Maina et al., 2016).

The projections of climate change scenarios developed in some of the examined papers indicate an increase in the frequency and intensity of numerous extreme weather events that will especially affect the most vulnerable geographical regions (Narayanan and Sahu, 2016; Park et al., 2015; Salik et al., 2015). For example, low coastal areas located in the Caribbean and African regions may be affected by sea level rise (Linnekamp et al., 2011; Lohmann, 2016; Molua, 2012). Likewise, the coastal zones located in the United States, Bangladesh and India are also highly exposed to the occurrence of various events such as hurricanes, tsunamis, landslides (Ahmed et al., 2016; Colten et al., 2015; Guleria and Patterson, 2012; Kim and Marcouiller, 2016; Rabbani et al., 2013; Sherly et al., 2015).

4.2. Adaptive capacity and social-ecological resilience

Seminal works by Adger (2006, 2000), Berkes et al. (2003), Berkes and Folke (1998), and Folke et al. (2004) established the theoretical roots on adaptive capacity. However, most of the identified articles have been published from 2002 onwards, indicating that empirical research in this field is a relatively recent topic. Despite the first publication having appeared in 2002 (O'Hare, 2002), it is only in the last decade that the importance of both adaptive capacity (to climate change and risk) and social-ecological resilience has been clearly reflected and broadly accepted (Fig. 2), changing from emerging concepts to consolidated topics in recent years. As evidence shows a total of 148 papers (77.08%) were published in the five-year period between 2012 and 2017. International journals such as Ocean & Coastal Management, Marine Policy and Ecology and Society (highly linked to the Resilience Alliance) give special attention to these concepts.[1]

From a detailed analysis by topics, a similar distribution is observed between the three concepts in absolute and relative terms: social-ecological resilience (36.4%), adaptive capacity to climate change (31.8%) and adaptive capacity to risk (31.8%). However, this remarkable trend of increased publications on social-ecological resilience could be linked to the emerging field of disaster risk reduction in the year 2000, and the

[1] For 2018, one paper on adaptive capacity to risk and two papers on social-ecological resilience were found. They were excluded from the graph to facilitate the construction of the accumulative curve.

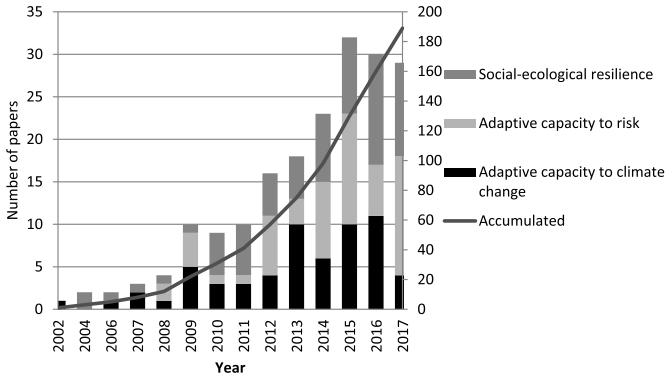


Fig. 2. Temporal distribution of coastal areas studies.

UN Millennium Declaration (Ajibade et al., 2013; Burton, 2015; Frazier et al., 2010; Heslinga et al., 2017; Wood and Good, 2004). As a result of the creation of a framework for the confrontation of disasters and in shaping prevention, preparedness and mitigation approaches in 1989, as well as an action plan in 1994 from the United Nations, resilience studies were integrated into the framework of the International Strategy for Disaster Resilience and the Hyogo Framework for Action 2005–2015 (Toseroni et al., 2016). In order to respond to the numerous catastrophic events that have affected coastal areas worldwide in the past (Adger et al., 2005; Burton, 2015), several strategies have been put into practice. For example, to face cyclonic disasters, four phases have been structured: response, recovery, prevention/reduction and preparation (Hoque et al., 2017; Torres et al., 2018).

On the other hand, adaptive capacity has been a concept with continuous growing relevance since 1992 mostly related to the United Nations Framework Convention on Climate Change and the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1998 (Buenfil, 2009). The evolution of the concept over time seems to match with the several evaluation reports published by the IPCC (2014, 2007, 2001, 1995, 1990). Adaptation to climate change, especially in the context of developing countries, has gained attention due to the need to draw up strategies that allow communities to face their effects. Within the political context and the scientific literature, adaptation to climate change has also gained relevance, especially in the context of developing countries. The design of strategies that allow coping of the most vulnerable communities in face of the effects derived from this phenomenon is increasingly urgent (Maina et al., 2016; Mohammed et al., 2017; Smith et al., 2013; Uy et al., 2011; Wrathall et al., 2014).

4.2.1. Temporal and spatial distribution

The identified studies were carried out on 76 countries across five continents (Map 1). Of these publications, the highest number corresponds to the American continent (mainly from the United States of America and Brazil) (19.27%) and the lowest to the African continent (3.1%). It should be noted that out of all papers examined, only 21 were conducted within protected areas (10.9%). In this subset we found 12 studies focused on adaptive capacity to risk, six on social-ecological resilience and three on adaptive capacity to climate change. Map 1 shows the distribution of the studies, some of them have more than one geographical location along different countries. In the map shown, the size of the circle represents the number of studies conducted in each of the geographic regions, while the points refer to the location of the case studies. The points and sections of the circles in gray show the studies carried out within protected areas, while the black ones correspond to non-protected areas.

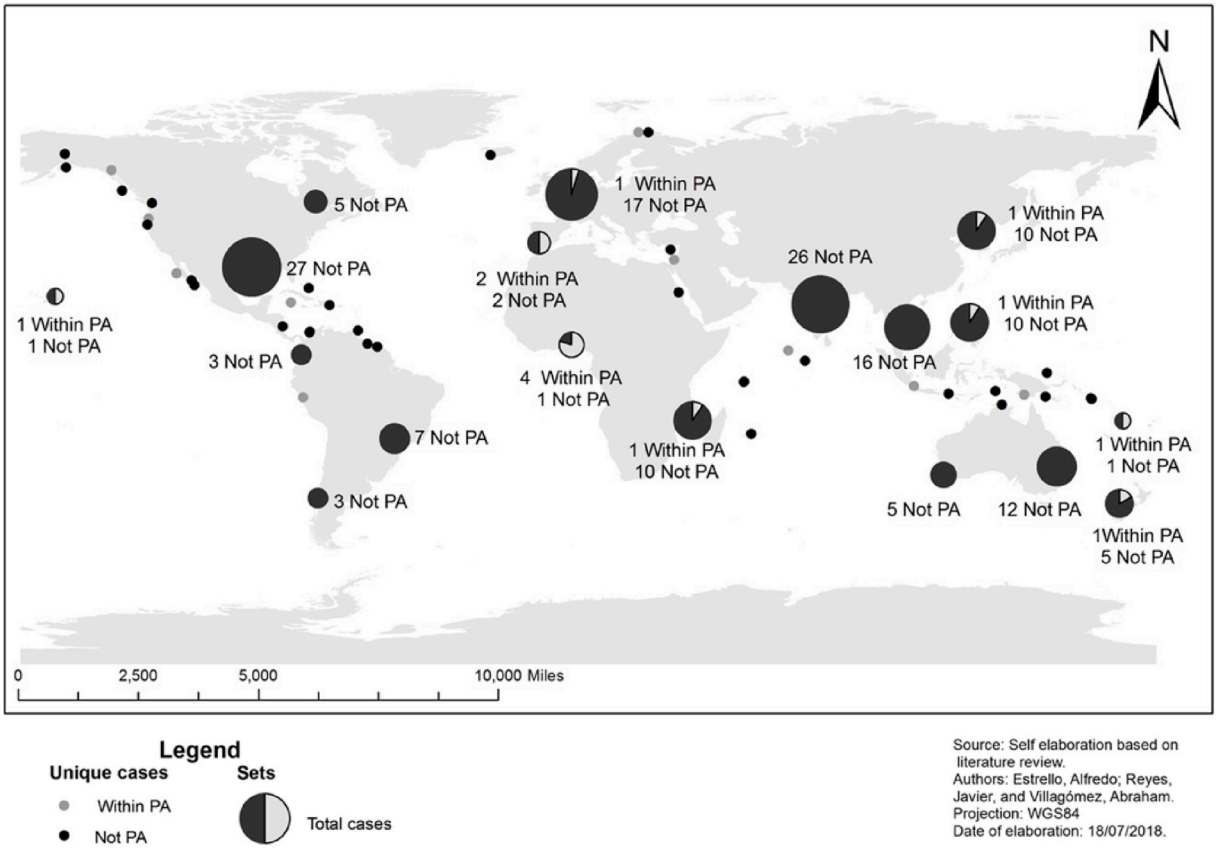
Sporadic and punctual studies have been carried out in regions classified as highly vulnerable to the effects of climate change and the influence of anthropic risks (IPCC, 2007; Kirch et al., 2017; Müller et al., 2014). This is evident in the African continent and the Caribbean islands, which are poorly represented in the reviewed literature (Bunce et al., 2010; Cinner et al., 2009; Mycoo, 2014; Scott et al., 2012; Tompkins et al., 2008; Torre-Castro and Ronnback, 2004).

The studies examined are mainly located in specific geographic regions where there is a high occurrence of events. For example, in North America, research tends to be concentrated mostly in the Southeastern region of the United States of America, as it is prone to the occurrence of strong events that have caused considerable damage to ecosystems and the livelihoods of communities including the Katrina, Ike and Sandy events (Burton, 2015; KC et al., 2015; Smallegan et al., 2016; Van Zandt et al., 2012). Moreover, this region is located in one of the most important oil producing regions in the world with great contribution for the Gross National Product. Likewise, Australia has been influenced by disaster events associated with floods and the effects of climate change (Astill, 2017; Espada et al., 2017; Vasey-Ellis, 2009), which affects the majority of its population living on the coasts (85%), many whose means of life have a great dependence on coastal ecosystems (Metcalf et al., 2015). The studies concentrated in Africa do not only show the vulnerability of this continent to the effects of climate change, but also identify factors such as the geographical position of some countries including Tanzania, Kenya, Mozambique, Madagascar and the socio-economic conditions facing their countries. The Asian region and Oceania, are classified as regions of high disaster risk, presenting elevated levels of exposure to natural disaster threats such as floods, sea level rise, hurricanes, droughts, earthquakes, acidification of oceans, increase of droughts, intensity and frequency of storms (Aliagha et al., 2015; Chang and Huang, 2015; Duffy, 2011; Goda and De Risi, 2017; Kirch et al., 2017; Lan et al., 2013; Rahman et al., 2015).

Also, in geographical terms, the main focus of studies in protected areas is in Colombia, which represents 14.28% of the total number of investigations conducted in these sites. This indicates that currently the research carried out in protected areas has a greater representation in South America, which is explained by the marked interest that exists in the conservation of the diverse and rich biodiversity that characterizes this region.

4.3. Studies on policy formulation and measurement

The selected studies indicate in their objectives or research purposes the measurement and analysis of the factors that could affect adaptation processes in order to support formulation and design of management strategies and policies and decision-making processes (Brisley et al., 2016; Lazarus, 2016; Li et al., 2016; McNamara and Westoby, 2011; Nayak et al., 2014; Petheram et al., 2015; Savolainen et al., 2015; Singh-Peterson and Underhill, 2017). In relation to the purposes of the analyzed studies, Fig. 3 shows the increasing temporal distribution during the period 2002 to 2018 in the number of publications that propose to develop tools or actions for adaptation capacities (policy formulation) (65.1%). There is also an increase in the number of studies that focus on the measurement of the three analyzed concepts (34.9%). This increase in literature occurs in response to the various disaster events recorded in that period of time, in which many of the study sites examined analyze and promote various strategies to improve the adaptation of communities (Azril Mohamed et al., 2013; Chhotray and Few, 2012; Cobbinah et al., 2015; Dudley et al., 2015; Kim et al., 2017; O'Hare, 2002; Smallegan et al., 2016). Within this context, the focus is on identifying determining factors for adaptive capacity and social-ecological resilience as a consequence of the intensified effects of climate change and other types of risks. Through case studies and analysis of economic, environmental, political and institutional features, new forms of governance or management in coastal areas are promoted with the aim of improving adaptation (Galappaththi et al., 2017; Paterson et al., 2017). Examples can be observed in the studies developed in Tanzania (Zhang and Bakar, 2017), Mozambique (Hoguane et al., 2012) and the Maldives (Rasheed et al., 2016; Sovacool, 2012), where the objective of the study rests in the reconversion of inadequate management policies.



Map 1. Geographical distribution of studies within protected areas and non-protected areas in coastal regions.

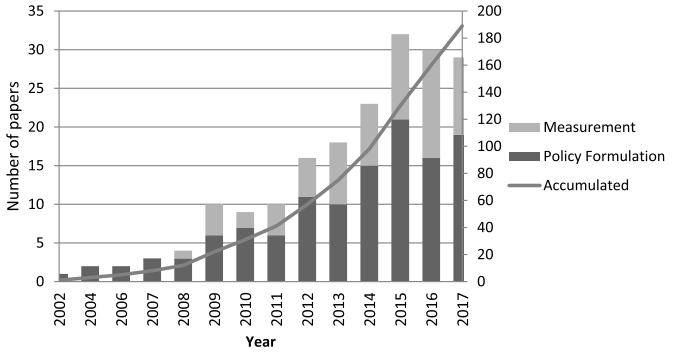


Fig. 3. Number of publications identified according to their research purposes[2].

4.3.1. Policy formulation

Several policy implications can be extracted to improve social-ecological resilience, the ability to adapt to risk and the ability to adapt to climate change. These implications include the promotion of research, management and policy intervention actions to help communities adapt to the risks arising from climate change, and other types of environmental and anthropic risks. There are few studies that highlight the importance of a gender approach and traditional indigenous knowledge in this type of research (Mulrennan, 2014). This is an important aspect to analyze, especially in the context of protected areas where little is known about the role of these factors in the adaptation of ecosystems and livelihoods. Taking these aspects into account can strengthen knowledge to support and suggest strategies and policy actions aimed at improving adaptation. For example, in the regions of Africa, Canada, Australia, New Zealand and the United States, policies could be aimed at developing research with a gender approach to examine the role of women and traditional and scientific knowledge in adaptation (Ajibade et al., 2013; Sayles and Mulrennan, 2010; Xiao and Van Zandt, 2012). In general, in all regions, the reviewed research highlights the importance of traditional and scientific knowledge in the design of strategies for the development of mitigation, preparation, response and recovery programs in response to various types of events (Du Bray et al., 2017; Frigerio and De Amicis, 2016; Johnston et al., 2014; Kim et al., 2016; MacCord and Begossi, 2006; McCay et al., 2014).

On the other hand, scientific research advocates for the inclusion of climate change and other risks scenarios, since they would allow to address the potential impacts generated in these situations, as they have deficiencies in this regard. Considering the different scenarios associated with the effects of climate change will allow for the formulation of strategies that reduce vulnerability and increase the adaptation of the communities that are under threat by these effects. However, communities are not only confronted with these effects, but also with the conditions fostered by the socioeconomic and institutional context that may also contribute to accentuate this vulnerability (Molua, 2012; Storbjörk and Hedrén, 2011). Few investigations examined through the systematic review observed in Spain, Australia, Cameroon and Ireland included the projections generated by the IPCC (Fatorić and Morén-Alegret, 2013; Geirsdóttir et al., 2014; Jiménez et al., 2017; Keys et al., 2016; McNamara et al., 2017; Molua, 2012). Another group of research generated in the United States and New Zealand, adopt other models of scenario projections generated by regional research projects (Elms, 2015; Frazier et al., 2010; Johnston et al., 2014).

The implementation of integrated coastal management and early warning systems are also identified as frameworks of action that can be effective to increase adaptation. This type of management can be an

[2] Note: For 2018, three papers focused on policy formulation. They were excluded from the graph to facilitate the construction of the accumulative curve.

essential scenario for the preparation to future climate change events, through the sustainable management of the natural resources that will allow the risk reduction of different potential disasters (Butler et al., 2016; Celliers et al., 2013; Faruque et al., 2017; Gjelsvik Tiller et al., 2014; Joffre et al., 2015; Khan and Amelie, 2015; McFadden et al., 2009; Sales, 2009; Steenbergen et al., 2017; Thomalla and Larsen, 2010; Tiller et al., 2014). This is a topic addressed in the research conducted in Spain, Cameroon, Australia, United States, New Zealand, India, Cambodia, Bangladesh, Solomon Islands, Brazil, Mozambique, South Africa, Thailand, Sri Lanka, Indonesia (Ajibade et al., 2013; Celliers et al., 2013; Fenemor et al., 2011; Guleria and Patterson, 2012; Hayward, 2008; Hossain and Paul, 2017; Lins-de-Barros, 2017; Pereira et al., 2009; Ratner et al., 2013; Thomalla and Larsen, 2010; Ung et al., 2016).

The promotion of flexible and inclusive governance systems through the improvement of traditional and cultural structures in environmental legislation are mentioned in research as factors that would favor adaptation in Australia, Spain, the United States of America, New Zealand, Brazil, Thailand, Sri Lanka, Indonesia, Mozambique, Nigeria, India, Ireland (Ahmed et al., 2014; Deason et al., 2014; Frick-Trzebitzky, 2017; González-Riancho et al., 2015; Hajra et al., 2017; Hofmeester et al., 2012; Johnston et al., 2014; Kim and Marcouiller, 2016; MacCord and Begossi, 2006; Mycoo, 2015). This approach would gather the needs and concerns of all stakeholders involved, coordinating in a harmonized manner the promotion of adaptation strategies to face disaster events (Garg et al., 2007; González-Riancho et al., 2015). Indeed, research conducted in Ghana and Norway supports the idea that fostering flexible and inclusive governance systems is the foundation for adaptation (Angell and Stokke, 2014; Frick-Trzebitzky, 2017; Tiller and Richards, 2015).

Innovative credit agreements to diversify the livelihoods of fishermen affected by the reduction of their catches and increase their capacity for adaptive and social-ecological resilience are also part of the policy formulation addressed by Brazilian research (Haque et al., 2015). However, Ferrol-Schulte et al. (2015) point out that the dependence on these types of credits can be counterproductive for adaptation because, in the Indonesian context at least, they do not favor the sustainable use of marine resources and the adaptation of fishermen.

Likewise, it will be necessary to increase the levels of environmental awareness, communication and information among all stakeholders (Espiner and Becken, 2014; Hogg et al., 2018; Stoffle and Minnis, 2007). The adoption of new forms of governance adaptive policies and the formulation of integrative policies should be based in learning and collaboration and include the participation of the scientific sector, non-governmental organizations, government agencies, communities and the private sector (Bunce et al., 2010). Taking advantage of social learning acquired from populations that have already experienced disasters can also represent a successful way to improve decision-making processes and improve social-ecological resilience (Takasaki, 2016). Additionally, supporting co-management of fisheries resources, institutional arrangements and legal frameworks, in order to define roles and responsibilities among the participants would contribute to the adaptation of communities in protected areas (Levine and Richmond, 2014; McClenachan et al., 2015; West and Hovelsrud, 2010).

Within the literature on adaptation, the need to adopt an institutional framework that considers the anticipated planning of new actions to develop effective adaptation strategies in the coastal context before the effects of climate change and coastal erosion is pointed out (Drejza et al., 2011; Few et al., 2007; Kettle and Dow, 2014; Larsen et al., 2008). To accomplish this is important in order to focus governmental arrangements not only towards the establishment of jurisdictional limits but also towards considering natural processes. Given that the latter does not conform to institutionally established processes, planning is required to mediate these interrelationships from a local, regional and interregional ecosystem perspective. It is considered that through the framework of the socio-ecological resilience management and planning practices it is possible to transform, maintain and strengthen decision making, in response to natural processes which may involve different actions (Lloyd et al., 2013; Novak et al., 2017).

4.3.2. Measurement studies

It should be observed that the increase in the number of studies that propose the measurement of adaptive capacity, adaptation, and socio-ecological resilience within an empirical approach indicates a movement towards the quantification of these concepts. This process, known as operationalization, presupposes the refining of theoretical constructs and their definition into variables that can be deemed observable. It indicates higher accuracy and understanding of the characteristics that influence the development of adaptive capacities (Engle, 2011). For example, 24 studies measuring adaptive capacity to climate change and adaptive capacity to risk were identified independently and 19 studies measuring social-ecological resilience. In the analyzed publications, the use of measurement procedures is observed through systems of indicators and indices that seek to measure socio economic dimensions. Among them, the social adaptive capacity index stands out (Camargo et al., 2009; Cinner et al., 2009; Maina et al., 2016; McClanahan et al., 2008); it includes the evaluation of social capital, occupational mobility, anticipation of change, material assets, and technology.

The number of proposed tools is high, indicating a lack of convergence towards the use of a single measurement procedure. For instance, three adaptive capacity measurement methods propose using in their models' determinants of adaptive capacity that have yielded significant results in other research before the occurrence of cyclones, coastal erosion and coastal flooding. Among them are the generic adaptive capacity indicators such as formal education, traditional knowledge and perceptions of environmental or coastal risk/changes indicators (Boyer-Villemaire et al., 2014; Sharma et al., 2013; Sharma and Patwardhan, 2008). In the case of social-ecological resilience studies for example, there are methods to evaluate the adaptation and propose indicators to measure the changes experienced by communities facing adverse events such as climate change, hurricanes and cyclones. Among them are resilience indicators (Schwarz et al., 2011); social vulnerability indicators (Van Zandt et al., 2012); metrics resilience to natural hazards and disasters (Burton, 2015) and the Coastal Community Resilience Index (DasGupta and Shaw, 2015). Social-ecological resilience has also been measured through other proposals that come from authors such as Akter and Mallick (2013); Busby et al. (2014). While this plurality of measurement frameworks reflects local peculiarities in community adaptation and resilience processes, the lack of consensus affects the understanding of these processes at the regional level (Ramenzoni and Yoskowitz, 2017). It should be noted that most studies focused on measurement integrate primary data obtained through surveys, interviews, and focus groups; with secondary data such as official censuses. This may be the result of a greater orientation towards the application of the results to direct management policies. However, in a few cases the authors discuss models of transition from empirical findings to concrete intervention programs (Akter and Mallick, 2013; DasGupta and Shaw, 2015; Solecki et al., 2017; Teschner et al., 2012).

Within the field of adaptation, efforts directed towards the operationalization of SES resilience and AC are highlighted. Some authors consider measurement research as the most complete, since it offers important theoretical and normative contributions that allow giving a greater theoretical and practical support to the actions directed at improving social-ecological resilience and adaptive capacity (Asadzadeh et al., 2017; DasGupta and Shaw, 2015; Engle, 2011). However, although the operationalization of these concepts still represents a challenge, the systematic review reported that there has been a gradual increase in the number of studies that reflect this aspect within adaptation literature (Burton, 2015; Cinner et al., 2012, 2009; Diedrich et al., 2017; Marshall et al., 2010; Nhuan et al., 2016).

In general, within the objectives and purposes of an investigation, the conceptual approaches and methodologies that should be implemented are defined (Jurgilevich et al., 2017). The review of the studies reveals that adaptation represents the ideal state to achieve so that coastal communities can cope with the effects of climate change and other types of climatic and anthropic risks. The measurement methods used by these studies are fed by diverse sources of information (primary, secondary or the combination of both).

4.3.2.1. Social-ecological resilience. In studies that measure social-ecological resilience, some factors that promote it have been recognized based on the use of different socio-environmental indicators (e.g. family income, employed population): institutional (existence of risk mitigation plans, flood insurance programs), community (social defense organizations, religious) and environmental (frequency of weather events). These aspects are evidenced in research conducted in the United States, the leading country in these types of studies, in coastal communities affected by the occurrence of disasters such as hurricanes, which in some cases improve their capacity for preparation and reconstruction after disasters (Burton, 2015; Cai et al., 2016; Kim et al., 2014; Kim and Marcouiller, 2016; Ross, 2016; Sherrieb et al., 2012). Other research carried out in Chilean coastal communities assess the social-ecological changes that have occurred as a result of the impact of hurricanes and tsunamis (Pitchon, 2011; Villagra et al., 2016), through focused indicators to measure perceived well-being, environmental values and job satisfaction as well as aspects that are included in the social, economic, infrastructure, community and environmental dimensions.

Social capital, identified through literature as a fundamental determinant to promote adaptation (Lyth et al., 2017; Morrison et al., 2017; Smith et al., 2012), has been addressed in research conducted in Bangladesh (Ahmed et al., 2016; Akter and Mallick, 2013; Jordan, 2015). Within these studies, aspects related to the institutional dimension and knowledge about adaptation are also included. Indicators of institutional scope are increasingly being recognized within the adaptation literature (Engle and Lemos, 2010) and this is also evidenced in the systematic review carried out, where case studies were found from India and the Solomon Islands (DasGupta and Shaw, 2015; Schwarz et al., 2011).

It is important to highlight that although a representation of this type of studies was observed in several regions of the world, this type of research is still concentrated in developed countries (United States). It is also necessary to point out that the studies found in the developing countries are mainly driven by scientific institutions chiefly from developed countries such as Sweden, Australia, United States, The Netherlands, among others.

4.3.2.2. Adaptive capacity to risk. The systematic review reveals the presence of numerous indicators of risk measurement (Bennett et al., 2014; Elrick-Barr et al., 2017; Sharma and Patwardhan, 2008). The measurement indicators designed to evaluate the adaptive capacity to risk have been used to quantify the damage endured by coastal communities, for example in the United States and Taiwan, as a consequence of urbanization, especially biophysical (e.g. temperature range) and socioeconomic (e.g. employment rate, family income) (Chu et al., 2017). From Bangladesh, another of the countries that are most threatened and affected by the influence of flood events, the index of perceived adaptability is developed by Saroar and Routray (2012). This index focuses fundamentally on social aspects (e.g. damage to infrastructure, loss of jobs).

Another approach that was found during the systematic review to assess the adaptive capacity to risk refers to the adoption of financial, social, human, physical and natural capital, which is also observed in several investigations conducted in Australia (Elrick-Barr et al., 2017; Metcalf et al., 2015; Tull et al., 2016). Finally, a joint research conducted between America and Europe (Canada, United Kingdom and Spain) developed a factor called Functional Awareness to Measure Adaptive Capacity against Coastal Erosion and Floods (Boyer-Villemaire et al., 2014).

Likewise, the systematic review also records that the adaptive capacity to risk is part of the assessments that have measured vulnerability of coastal communities in Indonesia, Taiwan, Italy, Viet Nam and Brazil (Alberico et al., 2017; Huang et al., 2012; Lins-de-Barros, 2017; Tran et al., 2017; Yoo et al., 2014). The adaptive capacity to risk, as a component that measures vulnerability, does not differ from the aspects that are frequently used in the literature; when this adaptive capacity to risk is evaluated independently (Hahn et al., 2009; Piya et al., 2016).

In protected areas, this type of adaptive capacity has been addressed through numerous indices, including social adaptive capacity (SAC) in the Philippines (Diedrich et al., 2017). This index integrates indicators related to economic aspects and social capital fundamentally. In Colombia, several studies have also been developed that address the impacts associated with anthropogenic activities such as overfishing and the establishment of protected areas (Camargo et al., 2009; López-Angarita et al., 2014; Moreno-Sánchez and Maldonado, 2013). The indices used in these cases also involve all the capitals (social, human, financial and institutional) (López-Angarita et al., 2014), and are somewhat similar to the index by Camargo et al. (2009), which is based on the use of socioeconomic indicators and governance (Moreno-Sánchez and Maldonado, 2013) through three dimensions: socio-economic, institutional and social-ecological; which approach the issue of the influence of the establishment of a protected area on the adaptive capacity of the communities established in that Colombian territory.

Similarly, the research developed by (Nenadović et al., 2016) focuses on analyzing the relationship between adaptive capacity, subsidy programs and participation in fisheries management based primarily on socioeconomic indicators. Unlike research on social-ecological resilience, it can be observed that when research was conducted in the context of protected areas, national institutions promoted a greater number of investigations.

4.3.2.3. Adaptive capacity to climate change. Adaptive capacity to climate change has been assessed mainly as part of vulnerability evaluations, as found by this research (Cinner et al., 2012; Moreno and Becken, 2009; Preston et al., 2009; Salik et al., 2015; Yoo et al., 2011). The most common indicators found for measuring adaptive capacity to climate change are socioeconomic (education level and participation in economic activities) (Narayanan and Sahu, 2016) and institutional factors in India (Yoo et al., 2011). Additionally, this review identifies that research that measure adaptive capacity in the Caribbean islands is not abundant. Lohmann (2016) evaluated adaptive capacity based on the perception towards different risks associated to potential change; the perceived capacity to plan, learn and reorganize to face change and to the level of interest to make a change when the analyzed phenomena is given. Likewise, a study carried out by Ung et al. (2016) in Cambodia deals with aspects such as knowledge in adaptation, confidence in personal skills as well as socioeconomic indicators to measure adaptive capacity. It is important to point out that none of the studies examining adaptive capacity to climate change was made in protected areas.

4.4. Comparison of studies within and outside protected areas

In studies carried out in protected areas (Fig. 4), eight studies were recorded on governance and policy, six on economic factors, three on climate change and other environmental stressors respectively, and one on infrastructure and technology. For studies conducted outside protected areas, 71 publications on other environmental stressors are recorded, 66 on climate change, 13 on infrastructure and technology, 9 on economic stressors, 9 on governance and policy and 3 on demographic factors.

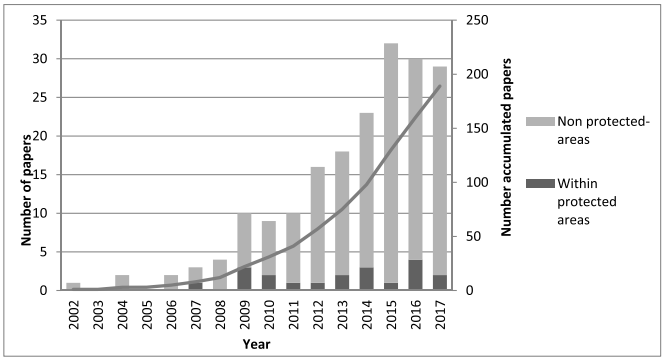


Fig. 4. Studies carried out within and non-protected areas.

Although in recent years there has been progress in research on adaptation outside protected areas, the scientific literature indicates that it will be through the intervention of these protected sites that the conservation and provision of quality ecosystem services will be achieved. This, in turn, will support the adaptive capacity and resilience of coastal communities in face of different climatic and anthropogenic events (Ledee et al., 2012; Takasaki, 2016).[3]

In protected areas, it is also expected that the effects of climate change in conjunction with various anthropogenic stressors (urbanization, land use change and economic activities) impact on coastal ecosystems (Bunce et al., 2010; Camargo et al., 2009; Nenadović et al., 2016). The lack of effective actions to face the impacts of climate change and other climatic and anthropogenic risks can compromise conservation objectives delineated by protected areas. For this reason, policies that contribute to improving aspects related to the management of coastal ecosystems are required; these should promote the incorporation of communities in decision making, introduce alternative sources of income for the diversification of occupations and eliminate the complete dependence on the use of coastal ecosystems. In addition, they should conduct research in protected areas, monitor biodiversity, and train personnel in the protected area so that these areas have a better performance in the adaptation of coastal ecosystems and communities in general.

The lack of such effective actions to face the impacts of climate change and other climatic and anthropogenic risks may compromise conservation objectives delineated by protected areas. Additionally, policies should encourage research in protected areas with an emphasis on monitoring biodiversity and the social problems afflicting communities established in protected areas and their surroundings. One of the most fundamental aspects that would improve the effectiveness of actions aimed at adapting coastal ecosystems and local communities is the increased training of protected areas personnel (Camargo et al., 2009). The thematic approach of the literature examined shows that studies on policy formulation surpass those directed towards the measurement or operationalization of social-ecological resilience and adaptive capacity. Currently, policy formulation helps to highlight some specific factors that are manifested as part of the geographical, social and environmental context. For this reason, the policy formulation may differ in each region studied according to the circumstances and types of events that occur.

In protected areas, the measurement of social-ecological resilience is not representative since only two investigations carried out in Madagascar and Egypt were detected (Cinner et al., 2009; Marshall et al., 2010). The indices used are adjusted to fundamentally measure economic, social, institutional and environmental factors; for example diversification of livelihoods, presence of governance institutions, learning capacity and access to assets and infrastructure of households, perceptions of change, practices environmental, knowledge and local experience (Marshall et al., 2010).

4.4.1. Protected areas

There is evidence in the scientific literature supporting the fact that protected areas are capable of reducing the vulnerability of fishing communities and improving their AC in face of the effects of climate change and other climatic and anthropogenic risks (Eriksson et al., 2017; Murti and Buyck, 2014). However, there are few case studies examined by this research that reflect this role (Eriksson et al., 2017; Takasaki, 2016). Among the identified causes are the inefficient management of coastal resources and their degradation as a latent problem, which is acknowledged in each of the investigations examined in countries like Brazil, Colombia, Egypt (Camargo et al., 2009; Faraco et al., 2016; Hoque et al., 2017; López-Angarita et al., 2014; Marshall et al., 2010).

However, when confronting the changes caused by climate change events and other climatic and anthropogenic risks, coastal communities respond in different ways. For example, in response to declining fish abundance, some communities in Spain considered making changes to their main economic activity (fishing) or redirecting it towards the capture of other species (Hogg et al., 2018); an alternative response is self-organization and requesting changes in the management regimes of protected areas, as shown by the communities of Paraguaná in Brazil (Faraco et al., 2016). The systematic review revealed that in face of environmental changes in coastal resources used to develop ecotourism activities, communities of New Zealand have implemented alternatives in the management of the activity that enable the adaptation they deem trustworthy in their capacity to confront future changes (Espiner and Becken, 2014).

Among the actions recommended by the papers examined are: adopting new proactive and flexible management approaches (Adams, 2010; Espiner and Becken, 2014); promoting consultation programs to support adaptation processes in the communities (Ledee et al., 2012); identifying the sources of vulnerability and impacts in order to propose actions that contribute to their reduction (Islam et al., 2014); and adopting infrastructure planning and collective participation of communities for adaptation (Frazier et al., 2010; Hogg et al., 2018; Johnston et al., 2014). Many coastal communities still keep reactive adaptation responses due to a lack of knowledge about what climate change means (Bennett et al., 2014; Elrick-Barr et al., 2016; Johnston et al., 2014; Peria et al., 2016).

4.5. Gaps of knowledge for adaptation

A number of important limitations related to the systematic review process and to the investigations have been identified in the present study. First, the study found little research done in protected areas. This made it impossible to gain a deeper understanding on how adaptation occurs in this context throughout the world. Also, most of the protected areas examined were marine national parks, which did not facilitate an analysis to examine the relationship between adaptation and management categories of protected areas. Therefore, this research considers that strategies of systematic reviews should be used to capture a larger number of studies because the subject of adaptation in recent years has evolved rapidly and revisions are required to include the new findings obtained.

Other limitations detected during the systematic review process are related to the application of different methodologies, which indicates that there is still no consensus on a common standard method to adopt or to operationalize the concepts of social-ecological resilience and adaptive capacity. It has also been found that research faces a lack of official information to study the topics of interest (Sharma and Patwardhan, 2008; Sherly et al., 2015; Su et al., 2015; Tran et al., 2017). Equally in the measurement studies, the selection of the

[3] Note: For 2018, one study carried out within a protected area and two studies outside a protected area were found. It was excluded from the graph to facilitate the construction of the accumulative curve.

variables has a strong subjective load (Cai et al., 2016; Cinner et al., 2012; Su et al., 2015) which can bias scientific results. These aspects have also been recognized within the literature on adaptation carried out in various regions of the world (Ainuddin and Routray, 2012; Asadzadeh et al., 2017; Bettini et al., 2015; Vyas and Kumaranayake, 2006).

Research related to the measurement of social-ecological resilience examines the ability to anticipate various risks and threats in order to reduce vulnerability. However, in the context of disaster risk reduction, resilience is defined as a process where the preparation, response and recovery of communities take place before events that produce disasters (Burton, 2015; Van Zandt et al., 2012). On this, the scientific literature recommends that the impacts produced by adverse events after an intervention occurs should be investigated in order to measure resilience more effectively (Joyce et al., 2018).

The barriers to adaptation can be overcome through some aspects examined in the research, which will contribute to reducing and facing numerous risks. These in turn have been mentioned as part of the policy formulation aimed at improving adaptation such as the recognition of accumulated traditional knowledge (Fenemor et al., 2011; Hoque et al., 2018; Saroar and Routray, 2012); improvement of social capital (Deason et al., 2014; Dolan and Walker, 2006; Orchard et al., 2015; Ramirez-Sanchez and Pinkerton, 2009); learning (Calhoun et al., 2016; Cinner et al., 2009; Tompkins et al., 2008), improving aspects of institutional aspects and deepening their influence on the reaction and adaptation of communities to changes and uncertainties (Bunce et al., 2010; Lemieux and Scott, 2011; McCay et al., 2014). These aspects have also been documented within the adaptation literature by several authors (Adger, 2003; Aldrich and Meyer, 2015; Granderson, 2017; Gupta et al., 2008; Lebel, 2013).

5. Conclusions

We found an increase in the number of studies addressing social-ecological resilience and adaptive capacity in recent years, which have a restricted spatial distribution and some geographic regions are underrepresented. Also, due to the growing changes that are projected as a result of the impact of climate change and other environmental and anthropic risks, the review reveals that the number of papers on social-ecological resilience, adaptive capacity to risk and adaptive capacity to climate change will increase in that order of importance. Among the most representative countries within each research category are the United States (social-ecological resilience), Bangladesh and the United States (adaptive capacity to risk) and Australia and India (adaptive capacity to climate change).

Of these studies, a small number correspond to studies conducted in protected areas. Colombia is the country with the highest number of publications in protected areas. The recognition of these countries among the geographic sites that are research centers coincides with the scientific literature that recognizes them as highly exposed and vulnerable to the occurrence of disaster events. However, the systematic review also found little research in other geographic regions that are similarly classified.

Important limitations and knowledge gaps were also identified, which could be partially overcome by improving the aspects exposed within the policy formulation and the measurement of the social-ecological resilience, the adaptive capacity to risk and adaptive capacity to climate change. Some of these aspects include promoting a greater number of studies on adaptation for the anticipation and prevention of various events, promoting development strategies for marginalized communities, fostering social learning based on experiences of past events among members of the communities, and flexible and inclusive governance systems to address adaptation more effectively.

The review also indicates that protected areas have deficiencies in the role of adaptation of social-ecological systems to the impacts of climate change, other climatic and anthropogenic risks. Among the causes identified by the studies examined is the inefficient management of the administrations of the protected areas of the coastal ecosystems. Experiences of adaptation strategies are recorded in the coastal communities established within and in the vicinity of the various areas in which changes have been produced by climate change and other environmental and anthropic risks, including the change of economic activity and collective action.

Although not all the investigations include the projections of the global climate change scenarios developed by the IPCC, they recognize the existing high probability that the studied regions will face, which will be affected by various socio-economic and biophysical stressors that will become more frequent and intense with the passage of time.

Acknowledgments

We appreciate all the comments made by anonymous reviewers for improving the quality of the present manuscript. The authors gratefully acknowledge the research support provided by the PhD program granted by the Consejo Nacional de Ciencia y Tecnología, México (CONACYT, Spanish acronym), through the El Colegio de la Frontera Sur and the technical support of the LaTSu (Transdisciplinary Laboratory for Sustainability).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ocecoaman.2019.01.005.

References

Adams, A., 2010. Planning for Cruise Ship Resilience: An Approach to Managing Cruise Ship Impacts in Haines , Alaska. Coast. Manag. 38, 654–664. https://doi.org/10.1080/08920753.2010.529035.

Adelekan, I., Fregene, T., 2015. Vulnerability of artisanal fishing communities to flood risks in coastal southwest Nigeria. Clim. Dev. 7, 322–338. https://doi.org/10.1080/17565529.2014.951011.

Adger, W.N., 2000. Social and ecological resilience: are they related? Prog. Hum. Geogr. 24, 347–364. https://doi.org/10.1191/030913200701540465.

Adger, N., 2003. Social Aspects of Adaptive Capacity. In: Climate Change, Adaptive Capacity and Development, pp. 29–49.

Adger, N., 2006. Vulnerability. Glob. Environ. Chang. 16, 268–281. https://doi.org/10.1016/j.gloenvcha.2006.02.006.

Adger, W.N., Hughes, T.P., Folke, C., Carpenter, S.R., Rockström, J., 2005. Social-ecological resilience to coastal disasters. Science 309, 1036–1039. https://doi.org/10.1126/science.1112122.

Agardy, T., Bridgewater, P., Crosby, M., Day, J., Dayton, P., Kenchington, R., Laffoley, D., McConney, P., Murray, P., Parks, J., Peau, L., 2003. Dangerous targets? Unresolved issues and ideological clashes around marine protected areas. Aquat. Conserv. Mar. Freshw. Ecosyst. 13, 353–367. https://doi.org/10.1002/aqc.583.

Agrawal, A., 2008. The Role of Local Institutions in Adaptation to Climate Change. In: Social Dimensions of Climate Change. Social Development Department, The World Bank, Washington DC, pp. 1–65.

Ahmadvand, M., Karami, E., Zamani, G.H., Vanclay, F., 2009. Evaluating the use of Social Impact Assessment in the context of agricultural development projects in Iran. Environ. Impact Assess. Rev. 29, 399–407. https://doi.org/10.1016/j.eiar.2009.03.002.

Ahmed, N., Bunting, S.W., Rahman, S., Garforth, C.J., 2014. Community-based climate change adaptation strategies for integrated prawn-fish-rice farming in Bangladesh to promote social-ecological resilience. Rev. Aquac. 6, 20–35. https://doi.org/10.1111/raq.12022.

Ahmed, B., Kelman, I., Fehr, H.K., Saha, M., 2016. Community Resilience to Cyclone Disasters in Coastal Bangladesh. Sustainability 8, 805. https://doi.org/10.3390/su8080805.

Ainuddin, S., Routray, J.K., 2012. Earthquake hazards and community resilience in Baluchistan. Nat. Hazards 63, 909–937. https://doi.org/10.1007/s11069-012-0201-x.

Ajibade, I., McBean, G., Bezner-Kerr, R., 2013. Urban flooding in Lagos, Nigeria: Patterns of vulnerability and resilience among women. Glob. Environ. Chang. 23, 1714–1725. https://doi.org/10.1016/j.gloenvcha.2013.08.009.

Akter, S., Mallick, B., 2013. The poverty-vulnerability-resilience nexus: Evidence from Bangladesh. Ecol. Econ. 96, 114–124. https://doi.org/10.1016/j.ecolecon.2013.10.008.

Alberico, I., Iavarone, R., Angrisani, A.C., Castiello, A., Incarnato, R., Barrra, R., 2017. The potential vulnerability indices as tools for natural risk reduction. The Volturno coastal plain case study. J. Coast Conserv. 21, 743–758. https://doi.org/10.1007/s11852-017-0534-4.

Alberini, A., Chiabai, A., Muehlenbachs, L., 2006. Using experet judgement to assess adaptive capacity to climate change: Evidence from a conjoint choice survey. Glob. Environ. Chang. 16, 123–144.
Aldrich, D.P., Meyer, M.A., 2015. Social capital and community resilience. Am. Behav. Sci. 59, 254–269. https://doi.org/10.1177/0002764214550299.
Aliagha, G.U., Mar Iman, A.H., Ali, H.M., Kamaruddin, N., Ali, K.N., 2015. Discriminant factors of flood insurance demand for flood-hit residential properties: A case for Malaysia. J. Flood Risk Manag. 8, 39–51. https://doi.org/10.1111/jfr3.12065.
Angell, E., Stokke, K.B., 2014. Vulnerability and adaptive capacity in Hammerfest, Norway. Ocean Coast Manag. 94, 56–65. https://doi.org/10.1016/j.ocecoaman.2013.11.009.
Arkema, K.K., Verutes, G.M., Wood, S.A., Clarke-Samuels, C., Rosado, S., Canto, M., Rosenthal, A., Ruckelshaus, M., Guannel, G., Toft, J., Faries, J., Silver, J.M., Griffin, R., Guerry, A.D., 2015. Embedding ecosystem services in coastal planning leads to better outcomes for people and nature. Proc. Natl. Acad. Sci. U. S. A. 112, 7390–7395. https://doi.org/10.1073/pnas.1406483112.
Asadzadeh, A., Kötter, T., Salehi, P., Birkmann, J., 2017. Operationalizing a concept: The systematic review of composite indicator building for measuring community disaster resilience. Int. J. Disaster Risk Reduct. 25, 147–162. https://doi.org/10.1016/j.ijdrr.2017.09.015.
Astill, S., 2017. Ageing in remote and cyclone-prone communities: geography, policy, and disaster relief. Geogr. Res. 55, 456–468. https://doi.org/10.1111/1745-5871.12228.
Aswani, S., Van Putten, I., Miñarro, S., 2017. Environmental and social recovery asymmetries to large-scale disturbances in small island communities. Nat. Hazards 86, 241–262. https://doi.org/10.1007/s11069-016-2685-2.
Awal, M., Rashid, M., Islam, A., Imam, M., Sarkar, M., 2016. Measuring Climate Change Vulnerability and its Adaptive Capacity: Policies and Planning for Bangladesh. Br. J. Environ. Clim. Change 6, 279–298. https://doi.org/10.9734/BJECC/2016/27382.
Azril Mohamed, H., Samah, B., Lawrence, J., Yassin, S., 2013. The process of social adaptation towards climate change among Malaysian fishermen. Int. J. Clim. Chang. Strateg. Manag. 5, 38–53.
Baggio, J.A., 2011. Multiple managers and heterogeneous landscapes: An integrated social-ecological network modelling approach.
Baggio, J., Calderón-Contreras, R., 2017. Socioecosistemas y resiliencia. Fundamentos para un marco analítico. In: Los Sistemas Socioecológicos y Su Resiliencia: Casos de Estudio, pp. 23–38.
Baggio, J., Brown, K., Hellebrandt, D., 2015. Boundary object or bridging concept? A citation network analysis of resilience. Ecol. Soc. 20, 12. https://doi.org/10.5751/ES-07484-200202.
Barbier, E.B., Hacker, S.D., Kennedy, C., Koch, E.W., Stier, A.C., Silliman, B.R., 2011. The value of estuarine and coastal ecosystem services. Ecol. Monogr. 81, 169–193. https://doi.org/10.1890/10-1510.1.
Below, T.B., Mutabazi, K.D., Kirschke, D., Franke, C., Sieber, S., Siebert, R., Tscherning, K., 2012. Can farmers' adaptation to climate change be explained by socio-economic household-level variables? Glob. Environ. Chang. 22, 223–235. https://doi.org/10.1016/j.gloenvcha.2011.11.012.
Bennett, N.J., Dearden, P., Murray, G., Kadfak, A., 2014. The capacity to adapt?: communities in a changing climate, environment, and economy on the northern Andaman coast of Thailand. Ecol. Soc. 19 (2). https://doi.org/10.5751/es-06315-190205.
Bennett, N., Blythe, J., Tyler, S., Ban, N., 2015a. Communities and change in the anthropocene: understanding social-ecological vulnerability and planning adaptations to multiple interacting exposures. Reg. Environ. Change 16, 907–926. https://doi.org/10.1007/s10113-015-0839-5.
Bennett, N., Dearden, P., Peredo, A., 2015b. Vulnerability to multiple stressors in coastal communities: a study of the Andaman coast of Thailand. Clim. Dev. 7, 124–141. https://doi.org/10.1080/17565529.2014.886993.
Berkes, F., 2015. Coasts for People. Interdisciplinary Approaches to Costal and Marine Resource Management, 1 edition. Routledge, New York.
Berkes, F., 2017. Environmental governance for the anthropocene? Social-ecological systems, resilience, and collaborative learning. Sustain 9, 12. https://doi.org/10.3390/su9071232.
Berkes, F., Folke, C., 1998. Linking social and ecological systems for resilience and sustainability. In: Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.
Berkes, F., Colding, J., Folke, C., 2003. Navigating social–ecological systems: building resilience for complexity and change, Cambridge. Biological Conservation, Estados Unidos. https://doi.org/10.1016/j.biocon.2004.01.010.
Bettini, Y., Brown, R.R., de Haan, F.J., 2015. Exploring institutional adaptive capacity in practice: examining water governance adaptation in Australia. Ecol. Soc. 20. https://doi.org/10.5751/ES-07291-200147.
Biggs, R., Schlüter, M., Schoon, M., 2015. Principles for Building Resilience: Sustaining Ecosystem Services in Social–Ecological Systems. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. https://doi.org/DOI:10.1017/CBO9781316014240.
Bockstael, E., Bahia, N.C., Seixas, C.S., Berkes, F., 2016. Participation in protected area management planning in coastal Brazil. Environ. Sci. Policy 60, 1–10. https://doi.org/10.1016/j.envsci.2016.02.014.
Booth, A., Papaioannou, D., Sutton, A., 2012. Systematic approaches to a successful literature review, Systematic approaches to a successful literature review. Sage, Los Angeles. https://doi.org/10.1080/02667363.2014.900913.
Boyd, E., Folke, C., 2011. Adapting institutions: Governance, complexity and social–ecological resilience, Adapting Institutions: Governance, Complexity and Social-Ecological Resilience. Cambridge University Press. https://doi.org/10.1017/CBO9781139017237.
Boyer-Villemaire, U., Bernatchez, P., Benavente, J., Cooper, J.A., 2014. Quantifying community's functional awareness of coastal changes and hazards from citizen perception analysis in Canada, UK and Spain. Ocean Coast Manag. 93, 106–120. https://doi.org/10.1016/j.ocecoaman.2014.03.016.
Brisley, R., Wylde, R., Lamb, R., Cooper, J., Sayers, P., Hall, J., 2016. Techniques for valuing adaptive capacity in flood risk management. Proc. Inst. Civ. Eng. Manag. 169, 75–84. https://doi.org/10.1680/jwama.14.00070.
Brody, S., Kim, H., Gunn, J., 2013. Examining the Impacts of Development Patterns on Flooding on the Gulf of Mexico Coast. Urban Stud. 50, 789–806. https://doi.org/10.1177/0042098012448551.
Brooks, N., Adger, W.N., Kelly, P.M., 2005. The determinants of vulnerability and adaptive capacity at the national level and the implications for adaptation. Glob. Environ. Chang. 15, 151–163. https://doi.org/10.1016/j.gloenvcha.2004.12.006.
Brosius, P.J., Tsing, A.L., Zerner, C., 2005. Communities and Conservation. Histories and Politics of Community-Based Natural Resource Management. In: International Journal of Environmental Studies. Altamira Press, Rowman Altamira, CA. https://doi.org/10.1080/00207230600720217.
Bruno, J., Bates, A., Cacciapaglia, C., Pike, E., Amstrup, S., Van Hooidonk, R., Henson, S., Aronson, R., Bruno, J., Bates, A., Cacciapaglia, C., Pike, E., Amstrup, S., Van Hooidonk, R., Henson, S., Aronson, R., 2018. Climate change threatens the world's marine protected areas. Nat. Clim. Change 8, 499. https://doi.org/10.1038/s41558-018-0149-2.
Buenfil, J., 2009. Adaptación a los impactos del cambio climático en los humedales costeros del Golfo de México, Volumen I. SEMARNAT-INE.
Bunce, M., Brown, K., Rosendo, S., 2010. Policy misfits, climate change and cross-scale vulnerability in coastal Africa: how development projects undermine resilience. Environ. Sci. Policy 13, 485–497. https://doi.org/10.1016/j.envsci.2010.06.003.
Burton, C., 2015. A Validation of Metrics for Community Resilience to Natural Hazards and Disasters Using the Recovery from Hurricane Katrina as a Case Study. Ann. Assoc. Am. Geogr. 105, 67–86. https://doi.org/10.1080/00045608.2014.960039.
Busby, J., Smith, T., Krishnan, N., 2014. Climate security vulnerability in Africa mapping 3.01. Polit. Geogr. 43, 51–67. https://doi.org/10.1016/j.polgeo.2014.10.005.
Butler, J.R.A., Bohensky, E.L., Suadnya, W., Yanuartati, Y., Handayani, T., Habibi, P., Puspadi, K., Skewes, T.D., Wise, R.M., Suharto, I., Park, S.E., Sutaryono, Y., 2016. Scenario planning to leap-frog the Sustainable Development Goals: An adaptation pathways approach. Clim. Risk Manag. 12, 83–99. https://doi.org/10.1016/j.crm.2015.11.003.
Cai, H., Lam, N., Zou, L., Qiang, Y., Kenan, L., 2016. Assessing Community Resilience to Coastal Hazards in the Lower Mississippi River Basin. Water 8, 1–18. https://doi.org/10.3390/w8020046.
Calderón-Contreras, R., 2010. Between environmental policy and scientific knowledge: How might dryland environments challenge ideas regarding ecological dynamics. Cienc. Ergo Sum. 17, 81–87.
Calderón-Contreras, R., 2016. El rol de las Áreas Naturales Periurbanas para la Resiliencia al Cambio Climático de las Metrópolis: El Caso de la Ciudad de México. Rev. iIberoamericana Econ. Ecológica 25, 69–79.
Calhoun, S., Conway, F., Russell, S., 2016. Acknowledging the voice of women: implications for fisheries management and policy. Mar. Pol. https://doi.org/10.1016/j.marpol.2016.04.033.
Camargo, C., Maldonado, J., Alvarado, E., Moreno-Sánchez, R., Mendoza, S., Manrique, N., Mogollón, A., Osorio, J., Grajales, A., Sánchez, J., 2009. Community involvement in management for maintaining coral reef resilience and biodiversity in southern Caribbean marine protected areas. Biodivers. Conserv. 18, 935–956. https://doi.org/10.1007/s10531-008-9555-5.
Carpenter, S., Walker, B., Anderies, J., Abel, N., 2001. From Metaphor to Measurement: Resilience of What to What? Ecosystems 4, 765–781. https://doi.org/10.1007/s10021-001-0045-9.
Castilla, J.C., Espinosa, J., Yamashiro, C., Melo, O., Gelcich, S., 2016. Telecoupling Between Catch, Farming, and International Trade for the Gastropods *Concholepas concholepas* (Loco) and *Haliotis* spp. (Abalone). J. Shellfish Res. 35, 499–506. https://doi.org/10.2983/035.035.0223.
Celliers, L., Rosendo, S., Coetzee, I., Daniels, G., 2013. Pathways of integrated coastal management from national policy to local implementation: Enabling climate change adaptation. Mar. Pol. 39, 72–86. https://doi.org/10.1016/j.marpol.2012.10.005.
Chang, L.F., Huang, S.L., 2015. Assessing urban flooding vulnerability with an emergy approach. Landsc. Urban Plann. 143, 11–24. https://doi.org/10.1016/j.landurbplan.2015.06.004.
Chen, I., Hsieh, C., Kondoh, M., Lin, H., Miki, T., Nakamura, M., Ohgushi, T., Urabe, J., Yoshida, T., 2017. Filling the gaps in ecological studies of socioecological systems. Ecol. Res. 32, 873–885. https://doi.org/10.1007/s11284-017-1521-9.
Chhotray, V., Few, R., 2012. Post-disaster recovery and ongoing vulnerability: Ten years after the super-cyclone of 1999 in Orissa, India. Glob. Environ. Chang. Policy Dimens. 22, 695–702. https://doi.org/10.1016/j.gloenvcha.2012.05.001.
Chu, A., Ling, Y.-C., Chiueh, P.-T., 2017. Incorporating the effect of urbanization in measuring climate adaptive capacity. Land Use Pol. 68, 28–38. https://doi.org/10.1016/j.landusepol.2017.07.019.
Cinner, J., Fuentes, M., Randriamahazo, H., 2009. Exploring Social Resilience in Madagascar ' s Marine Protected Areas. Ecol. Soc. 14, 41. https://doi.org/41.
Cinner, J., McClanahan, T., Graham, N., Daw, T., Maina, J., Stead, S., Wamukota, A., Brown, K., Bodin, O., 2012. Vulnerability of coastal communities to key impacts of climate change on coral reef fisheries. Glob. Environ. Chang. 22, 12–20. https://doi.org/10.1016/j.gloenvcha.2011.09.018.
Cobbinah, P.B., Black, R., Thwaites, R., 2015. Biodiversity conservation and livelihoods in rural Ghana: Impacts and coping strategies. Environ. Dev. 15, 79–93. https://doi.org/10.1016/j.envdev.2015.04.006.
Colten, C., Grimsmore, A., Simms, J., 2015. Oil spills and community resilience: uneven impacts and protection in historical perspective. Geogr. Rev. 105, 391–407. https://

doi.org/10.1111/j.1931-0846.2015.12085.x.
DasGupta, R., Shaw, R., 2015. An indicator based approach to assess coastal communities' resilience against climate related disasters in Indian Sundarbans. J. Coast Conserv. 19, 85–101. https://doi.org/10.1007/s11852-014-0369-1.
de Lange, E., Woodhouse, E., Milner-Gulland, E.J., 2016. Approaches Used to Evaluate the Social Impacts of Protected Areas. Conserv. Lett. 9, 327–333. https://doi.org/10.1111/conl.12223.
Deason, G., Seekamp, E., Barbieri, C., 2014. Perceived impacts of climate change, coastal development and policy on oyster harvesting in the Southeastern United States. Mar. Pol. 50, 142–150. https://doi.org/10.1016/j.marpol.2014.05.008.
Diedrich, A., Stoeckl, N., Gurney, G., Esparon, M., Pollnac, R., 2017. Social capital as a key determinant of perceived benefits of community-based marine protected areas. Conserv. Biol (This). https://doi.org/10.1111/cobi.12808.
Dolan, A., Walker, I., 2006. Understanding vulnerability of coastal communities to climate change related risks. In: J. Coast. Res. Proc. 8th Int. Coast. Symp. (ICS 2004), vol. III. pp. 1316–1323.
Drejza, S., Bernatchez, P., Dugas, C., 2011. Effectiveness of land management measures to reduce coastal georisks, eastern Québec, Canada. Ocean Coast Manag. 54, 290–301. https://doi.org/10.1016/j.ocecoaman.2011.01.001.
Du Bray, M.V., Wutich, A., Larson, K.L., White, D.D., Brewis, A., 2017. Emotion, Coping, and Climate Change in Island Nations: Implications for Environmental Justice. Environ. Justice 10, 102–107. https://doi.org/10.1089/env.2016.0025.
Dudley, N. (Ed.), 2008. Directrices para la aplicación de las categorías de gestión de áreas protegidas, . https://doi.org/10.2305/IUCN.CH.2008.PAPS.2.es.
Dudley, N., Stolton, S., Belokurov, A., Krueger, L., Lopoukine, N., MacKinnon, K., Sandwith, T., Sekhran, N., 2009. Soluciones Naturales: Las áreas protegidas ayudando a la gente a enfrentar el cambio climático. https://doi.org/10.1007/BF00514657.
Dudley, N., Buyck, C., Furuta, N., Pedrot, C., Renaud, F., Sudmeier-Rieux, K., 2015. Protected areas as tools for disaster risk reduction. In: A handbook for practitioners, . https://doi.org/10.1073/pnas.0703993104.
Duffy, D.C., 2011. No room in the ark? Climate change and biodiversity in the Pacific Islands of Oceania. Pac. Conserv. Biol. 17, 192–200. https://doi.org/10.1071/PC110192.
Egyir, I., Ofori, K., Antwi, G., Ntiamoa-Baidu, Y., 2015. Adaptive Capacity and Coping Strategies in the Face of Climate Change: A Comparative Study of Communities around Two Protected Areas in the Coastal Savanna and Transitional Zones of Ghana. J. Sustain. Dev. 8, 1–15. https://doi.org/10.5539/jsd.v8n1p1.
Elms, D., 2015. Improving community resilience to natural events. Civ. Eng. Environ. Syst. 32, 77–89. https://doi.org/10.1080/10286608.2015.1011626.
Elrick-Barr, C.E., Smith, T.F., Preston, B.L., Thomsen, D.C., Baum, S., 2016. How are coastal households responding to climate change? Environ. Sci. Policy 63, 177–186. https://doi.org/10.1016/j.envsci.2016.05.013.
Elrick-Barr, C., Thomsen, D.C., Preston, B., Smith, T., 2017. Perceptions matter: household adaptive capacity and capability in two Australian coastal communities. Reg. Environ. Change 17, 1141–1151. https://doi.org/10.1007/s10113-016-1016-1.
Engle, N., 2011. Adaptive capacity and its assessment. Glob. Environ. Chang. 21, 647–656. https://doi.org/10.1016/j.gloenvcha.2011.01.019.
Engle, N., Lemos, M., 2010. Unpacking governance: Building adaptive capacity to climate change of river basins in Brazil. Glob. Environ. Chang. 20, 4–13. https://doi.org/10.1016/j.gloenvcha.2009.07.001.
Eriksson, H., Albert, J., Albert, S., Warren, R., Pakoa, K., Andrew, N., 2017. The role of fish and fisheries in recovering from natural hazards: Lessons learned from Vanuatu. Environ. Sci. Policy 76, 50–58. https://doi.org/10.1016/j.envsci.2017.06.012.
Espada, R., Apan, A., McDougall, K., 2017. Vulnerability Assessment of Urban Community and Critical Infraestructures for integrated flood risk management and climate adaptation strategies. Int. J. Disaster Resil. Built Environ. 8, 375–411. https://doi.org/https://doi.org/10.1108/IJDRBE-03-2015-0010.
Espiner, S., Becken, S., 2014. Tourist towns on the edge: conceptualising vulnerability and resilience in a protected area tourism system. J. Sustain. Tourism 22, 646–665. https://doi.org/10.1080/09669582.2013.855222.
Faraco, L.F.D., Andriguetto Filho, J.M., Daw, T., Lana, P.D.C., Teixeira, C.F., 2016. Vulnerability Among Fishers in Southern Brazil and its Relation to Marine Protected Areas in a Scenario of Declining Fisheries. Desenvolv. e Meio Ambient 38, 51–76. https://doi.org/10.5380/dma.v38i0.45850.
Faruque, G., Sarwer, R.H., Karim, M., Phillips, M., Collis, W.J., Belton, B., Kassam, L., 2017. The evolution of aquatic agricultural systems in Southwest Bangladesh in response to salinity and other drivers of change. Int. J. Agric. Sustain. 15, 185–207. https://doi.org/10.1080/14735903.2016.1193424.
Fatorić, S., Morén-Alegret, R., 2013. Integrating local knowledge and perception for assessing vulnerability to climate change in economically dynamic coastal areas: The case of natural protected area Aiguamolls de l'Empordà, Spain. Ocean Coast Manag. 85, 90–102. https://doi.org/10.1016/j.ocecoaman.2013.09.010.
Felicetti, G., 2016. The Concept of Resilience Applied by Local Communities in Protected Area as Social-Economic-Ecological Systems (SEES). Environ. Manag. 17 (2016).
Fenemor, A., Phillips, C., Allen, W., Young, R.G., Harmsworth, G., Bowden, B., Basher, L., Gillespie, P.A., Kilvington, M., Davies-Colley, R., Dymond, J., Cole, A., Lauder, G., Davie, T., Smith, R., Markham, S., Deans, N., Stuart, B., Atkinson, M., Collins, A., 2011. Integrated catchment management-interweaving social process and science knowledge. N. Z. J. Mar. Freshw. Res. 45, 313–331. https://doi.org/10.1080/00288330.2011.593529.
Ferrol-Schulte, D., Gorris, P., Baitoningsih, W., Adhuri, D., Ferse, S., 2015. Coastal livelihood vulnerability to marine resource degradation: A review of the Indonesian national coastal and marine policy framework. Mar. Pol. 52, 163–171. https://doi.org/10.1016/j.marpol.2014.09.026.
Few, R., Brown, K., Tompkins, E., 2007. Climate change and coastal management decisions: Insights from Christchurch Bay, UK. Coast. Manag. 35, 255–270. https://doi.org/10.1080/08920750601042328.
Folke, C., 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. Glob. Environ. Chang. 16, 253–267. https://doi.org/10.1016/j.gloenvcha.2006.04.002.
Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L., Holling, C.S., 2004. Regime shifts, resilience, and biodiversity in ecosystem management. Annu. Rev. Ecol. Evol. Syst. 35, 557–581. https://doi.org/10.1146/annurev.ecolsys.35.021103.105711.
Folke, C., Carpenter, S., Walker, B., Scheffer, M., Chapin, T., Rockström, J., 2010. Resilience Thinking : Integrating Resilience , Adaptability and Transformability. Ecol. Soc. 15, 10. https://doi.org/10.1038/nnano.2011.191.
Frazier, T.G., Wood, N., Yarnal, B., 2010. Stakeholder perspectives on land-use strategies for adapting to climate-change-enhanced coastal hazards: Sarasota, Florida. Appl. Geogr. 30, 506–517. https://doi.org/10.1016/j.apgeog.2010.05.007.
Freduah, G., Fidelman, P., Smith, T.F., 2018. Mobilising adaptive capacity to multiple stressors: Insights from small-scale coastal fisheries in the Western Region of Ghana. Geoforum 91, 61–72. https://doi.org/10.1016/j.geoforum.2018.02.026.
Frick-Trzebitzky, F., 2017. Crafting Adaptive Capacity: Institutional Bricolage in Adaptation to Urban Flooding in Greater Accra. Water Altern. (WaA) 10, 625–647.
Frigerio, I., De Amicis, M., 2016. Mapping social vulnerability to natural hazards in Italy: A suitable tool for risk mitigation strategies. Environ. Sci. Policy 63, 187–196. https://doi.org/10.1016/j.envsci.2016.06.001.
Galappaththi, I.M., Galappaththi, E.K., Kodithuwakku, S.S., 2017. Can start-up motives influence social-ecological resilience in community-based entrepreneurship setting? Case of coastal shrimp farmers in Sri Lanka. Mar. Pol. 86, 156–163. https://doi.org/10.1016/j.marpol.2017.09.024.
Gallopin, G., 2006. Linkages between vulnerability, resilience, and adaptive capacity. Glob. Environ. Chang. 16, 293–303. https://doi.org/10.1016/j.gloenvcha.2006.02.004.
García, V., 2004. La perspectiva histórica en la antropología del riesgo y del desastre. Acercamientos metodologógicos. Relac. Estud. Hist. y Soc. XXV, 125–142.
Garg, A., Shukla, P.R., Kapshe, M., 2007. From climate change impacts to adaptation: A development perspective for India. Nat. Resour. Forum 31, 132–141. https://doi.org/10.1111/j.1477-8947.2007.00142.x.
Gasalla, M., 2011. Do all answers lie within (the community)? Fishing rights and marine conservation. In: Publishing, E.A. (Ed.), World Small Scale Fisheries Contemporary Visions. Eburon Academic Publishing, pp. 185–204.
Geirsdóttir, G., Gísladóttir, G., Jónsdóttir, Á., 2014. Coping with storm surges on the Icelandic south coast: A case study of the Stokkseyri village. Ocean Coast Manag. 94, 44–55. https://doi.org/10.1016/j.ocecoaman.2013.09.013.
Gjelsvik Tiller, R., Mork, J., Richards, R., Eisenhauer, L., Liu, Y., Nakken, J.F., Borgersen, Å.L., 2014. Something fishy: Assessing stakeholder resilience to increasing jellyfish (Periphylla periphylla) in Trondheimsfjord, Norway. Mar. Pol. 46, 72–83. https://doi.org/10.1016/j.marpol.2013.12.006.
Goda, K., De Risi, R., 2017. Probabilistic tsunami loss estimation methodology: stochastic earthquake scenario approach. Earthq. Spectra 33, 1301–1323. https://doi.org/10.1193/012617EQS019M.
González-Riancho, P., Gerkensmeier, B., Ratter, B.M.W., González, M., Medina, R., 2015. Storm surge risk perception and resilience: A pilot study in the German North Sea coast. Ocean Coast Manag. 112, 44–60. https://doi.org/10.1016/j.ocecoaman.2015.05.004.
Granderson, A.A., 2017. The Role of Traditional Knowledge in Building Adaptive Capacity for Climate Change: Perspectives from Vanuatu. Weather Clim. Soc. 9, 545–561. https://doi.org/10.1175/WCAS-D-16-0094.1.
Grecksch, K., 2013. Adaptive capacity and regional water governance in north-western Germany. Water Pol. 15, 794–815. https://doi.org/10.2166/wp.2013.124.
Guleria, S., Patterson, J., 2012. Coastal community resilience: analysis of resilient elements in 3 districts of Tamil Nadu State, India. J. Coast Conserv. 16, 101–110. https://doi.org/10.1007/s11852-011-0178-8.
Gunderson, L.H., Holling, C.S., 2002. In: Island, Pr (Ed.), Panarchy: understanding transformations in systems of humans and nature.
Gupta, J., Termeer, K., Klostermann, J., Meijerink, S., Van den Brink, M., Jong, P., Nooteboom, S., 2008. Institutions for Climate Change: A Method to Assess the Inherent Characteristics of Institutions to enable the Adaptive Capacity of Society. Institute for Environmental Studies. https://doi.org/10.1016/0959-3780(92)90035-6.
Gupta, J., Termeer, C., Klostermann, J., Meijerink, S., Van den Brink, M., Jong, P., Nooteboom, S., Bergsma, E., 2010. The Adaptive Capacity Wheel: A method to assess the inherent characteristics of institutions to enable the adaptive capacity of society. Environ. Sci. Policy 13, 459–471. https://doi.org/10.1016/j.envsci.2010.05.006.
Gupta, J., Bergsma, E., Termeer, C.J.A.M., Biesbroek, G.R., Van den Brink, M., Jong, P., Klostermann, J.E.M., Meijerink, S., Nooteboom, S., 2016. The adaptive capacity of institutions in the spatial planning, water, agriculture and nature sectors in the Netherlands. Mitig. Adapt. Strategies Glob. Change 21, 883–903. https://doi.org/10.1007/s11027-014-9630-z.
Hagerman, S., Dowlatabadi, H., Chan, K., Satterfield, T., 2010. Integrative propositions for adapting conservation policy to the impacts of climate change. Glob. Environ. Chang. 20, 351–362. https://doi.org/10.1016/j.gloenvcha.2009.11.002.
Hahn, M.B., Riederer, A.M., Foster, S.O., 2009. The Livelihood Vulnerability Index: A pragmatic approach to assessing risks from climate variability and change-A case study in Mozambique. Glob. Environ. Chang. 19, 74–88. https://doi.org/10.1016/j.gloenvcha.2008.11.002.
Hajra, R., Szabo, S., Tessler, Z., Ghosh, T., Matthews, Z., Foufoula-Georgiou, E., 2017. Unravelling the association between the impact of natural hazards and household poverty: evidence from the Indian Sundarban delta. Sustain. Sci. 12, 453–464.

https://doi.org/10.1007/s11625-016-0420-2.
Haque, C., Idrobo, C., Berkes, F., Giesbrecht, D., 2015. Small-scale fishers' adaptations to change: The role of formal and informal credit in Paraty, Brazil. Mar. Pol. 51, 401–407. https://doi.org/10.1016/j.marpol.2014.10.002.
Hayward, B., 2008. Nowhere far from the sea: Political challenges of coastal adaptation to climate change in New Zealand. Polit. Sci. 60, 47–59. https://doi.org/10.1177/003231870806000105.
Henly-Shepard, S., Gray, S.A., Cox, L.J., 2015. The use of participatory modeling to promote social learning and facilitate community disaster planning. Environ. Sci. Policy 45, 109–122. https://doi.org/10.1016/j.envsci.2014.10.004.
Heslinga, J., Groote, P., Vanclay, F., 2017. Using a social-ecological systems perspective to understand tourism and landscape interactions in coastal areas. J. Tour. Futur. 3, 23–38. https://doi.org/10.1108/jtf-10-2015-0047.
Hicks, C.C., McClanahan, T.R., Cinner, J.E., Hills, J.M., 2009. Trade-offs in values assigned to ecological goods and services associated with different coral reef management strategies. Ecol. Soc. 14, 10. https://doi.org/10.
Hofmeester, C., Bishop, B., Stocker, L., Syme, G., 2012. Social cultural influences on current and future coastal governance. Futures 44, 719–729. https://doi.org/10.1016/j.futures.2012.04.002.
Hogg, K., Semitiel-García, M., Noguera-Méndez, P., Gray, T., Young, S., 2018. Perceptions of Threats Facing Cabo de Palos - Islas Hormigas MPA and Potential Solutions. Coast. Manag. 46, 58–74. https://doi.org/10.1080/08920753.2018.1405330.
Hoguane, A.M., Cuamba, E. da L., Gammelsrød, T., 2012. Influence of rainfall on tropical coastal artisanal fisheries: a case study of Northern Mozambique. Rev. Gestão Costeira Integr. 12, 477–482. https://doi.org/10.5894/rgci338.
Holling, C.S., 1973. Resilience and Stability of Ecological Systems. Annu. Rev. Ecol. Syst. 4, 1–23. https://doi.org/10.1146/annurev.es.04.110173.000245.
Hopkins, C.R., Bailey, D.M., Potts, T., 2016. Perceptions of practitioners: Managing marine protected areas for climate change resilience. Ocean Coast Manag. 128, 18–28. https://doi.org/10.1016/j.ocecoaman.2016.04.014.
Hoque, M.A.A., Phinn, S., Roelfsema, C., 2017. A systematic review of tropical cyclone disaster management research using remote sensing and spatial analysis. Ocean Coast Manag. 146, 109–120. https://doi.org/10.1016/j.ocecoaman.2017.07.001.
Hoque, S.F., Quinn, C., Sallu, S., 2018. Differential livelihood adaptation to social-ecological change in coastal Bangladesh. Reg. Environ. Change 18, 451–463. https://doi.org/10.1007/s10113-017-1213-6.
Hossain, M.N., Paul, S.K., 2017. Simulation of physical and socioeconomic factors of vulnerability to cyclones and storm surges using GIS: a case study. Geojournal 82, 23–41. https://doi.org/10.1007/s10708-015-9668-9.
Huang, Y., Li, F., Bai, X., Cui, S., 2012. Comparing vulnerability of coastal communities to land use change: Analytical framework and a case study in China. Environ. Sci. Policy 23, 133–143. https://doi.org/10.1016/j.envsci.2012.06.017.
IPCC, 1990. Climate change: The IPCC Scientific Assessment. Mass, Cambridge.
IPCC, 1995. IPCC Second Assessment Climate Change 1995. A report of the Intergovernmental Panel on Climate Change.
IPCC, 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. A report of Working Group II of the Intergovernmental Panel on Climate Change.
IPCC, 2007. Climate change 2007: Impacts, adaptation and vulnerability. J. Geophys. Res. https://doi.org/10.1029/93JC02439.
IPCC, 2014. Climate change 2014: Impacts, adaptation, and vulnerability, Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
Islam, M., Sallu, S., Hubacek, K., Paavola, J., 2014. Vulnerability of fishery-based livelihoods to the impacts of climate variability and change: insights from coastal Bangladesh. Reg. Environ. Change 14, 281–294. https://doi.org/10.1007/s10113-013-0487-6.
Jiménez, J., Valdemoro, H.I., Bosom, E., Sánchez-Arcilla, A., Nicholls, R.J., 2017. Impacts of sea-level rise-induced erosion on the Catalan coast. Reg. Environ. Change 17, 593–603. https://doi.org/10.1007/s10113-016-1052-x.
Joffre, O.M., Bosma, R.H., Bregt, A.K., van Zwieten, P., Bush, S.R., Verreth, J., 2015. What drives the adoption of integrated shrimp mangrove aquaculture in Vietnam? Ocean Coast Manag. 114, 53–63. https://doi.org/10.1016/j.ocecoaman.2015.06.015.
Johnston, A., Slovinsky, P., Yates, K.L., 2014. Assessing the vulnerability of coastal infrastructure to sea level rise using multi-criteria analysis in Scarborough, Maine (USA). Ocean Coast Manag. 95, 176–188. https://doi.org/10.1016/j.ocecoaman.2014.04.016.
Jones, N., McGinlay, J., Dimitrakopoulos, P.G., 2017. Improving social impact assessment of protected areas: A review of the literature and directions for future research. Environ. Impact Assess. Rev. 64, 1–7. https://doi.org/10.1016/j.eiar.2016.12.007.
Jones, N., Malesios, C., Ioannidou, E., Kanakaraki, R., Kazoli, F., Dimitrakopoulos, P.G., 2018. Understanding perceptions of the social impacts of protected areas: Evidence from three NATURA 2000 sites in Greece. Environ. Impact Assess. Rev. 73, 80–89. https://doi.org/10.1016/j.eiar.2018.07.006.
Jordan, J.C., 2015. Swimming alone? The role of social capital in enhancing local resilience to climate stress: a case study from Bangladesh. Clim. Dev. 7, 110–123. https://doi.org/10.1080/17565529.2014.934771.
Joyce, S., Shand, F., Tighe, J., Laurent, S.J., Bryant, R.A., Harvey, S.B., 2018. Road to resilience: a systematic review and meta-analysis of resilience training programmes and interventions. BMJ Open 8, e017858. https://doi.org/10.1136/bmjopen-2017-017858.
Jurgilevich, A., Räsänen, A., Groundstroem, F., Juhola, S., 2017. A systematic review of dynamics in climate risk and vulnerability assessments. Environ. Res. Lett. 12. https://doi.org/10.1088/1748-9326/aa5508.
KC, B., Shepherd, J.M., Gaither, C.J., 2015. Climate change vulnerability assessment in Georgia. Appl. Geogr. 62, 62–74. https://doi.org/10.1016/j.apgeog.2015.04.007.
Kelleher, G., 1999. Guidelines for Marine Protected Areas. In: IUCN (Ed.), Environmental Conservation. Gland, Switzerland and Cambridge, . https://doi.org/10.1017/S0376892901290304.
Kerry, J., Pruneau, D., Blain, S., Langis, J., Barbier, P., Mallett, M., Vichnevetski, E., Therrien, J., Deguire, P., Freiman, V., Lang, M., Laroche, A., 2012. Human competences that facilitate adaptation to climate change: a research in progress. Int. J. Clim. Chang. Strateg. Manag. 4, 246–259.
Keskitalo, C., Dannevig, H., Hovelsrud, G., West, J., Swartling, Å., 2011. Adaptive capacity determinants in developed states: Examples from the Nordic countries and Russia. Reg. Environ. Change 11, 579–592. https://doi.org/10.1007/s10113-010-0182-9.
Kettle, N., Dow, K., 2014. Cross-level differences and similarities in coastal climate change adaptation planning. Environ. Sci. Policy 44, 279–290. https://doi.org/10.1016/j.envsci.2014.08.013.
Keys, N., Thomsen, D.C., Smith, T.F., 2016. Adaptive capacity and climate change: the role of community opinion leaders. Local Environ. 21, 432–450. https://doi.org/10.1080/13549839.2014.967758.
Khan, A., Amelie, V., 2015. Assessing climate change readiness in Seychelles: implications for ecosystem-based adaptation mainstreaming and marine spatial planning. Reg. Environ. Change 15, 721–733. https://doi.org/10.1007/s10113-014-0662-4.
Kim, H., Marcouiller, D., 2016. Natural Disaster Response, Community Resilience, and Economic Capacity: A Case Study of Coastal Florida. Soc. Nat. Resour. 29, 981–997. https://doi.org/10.1080/08941920.2015.1080336.
Kim, H., Woosnam, K.M., Aleshinloye, K.D., 2014. Evaluating coastal resilience and disaster response: the case of galveston and texas Gulf counties following Hurricane Ike. Coast. Manag. 42, 227–245. https://doi.org/10.1080/08920753.2014.904188.
Kim, J., Kang, H.W., Son, C.-Y., Moon, Y.-I., 2016. Spatial variations in typhoon activities and precipitation trends over the Korean Peninsula. J. Hydro Environ. Res. 13, 144–151. https://doi.org/10.1016/j.jher.2014.12.005.
Kim, M., You, S., Chon, J., Lee, J., 2017. Sustainable land-use planning to improve the coastal resilience of the social-ecological landscape. Sustain 9. https://doi.org/10.3390/su9071086.
Kirch, L., Luther, S., Mucke, P., Prütz, R., Radtke, K., Schrader, C., 2017. World Risk Report Analysis and prospects 2017. Berlin.
Kithiia, J., Dowling, R., 2010. An integrated city-level planning process to address the impacts of climate change in Kenya: The case of Mombasa. Cities 27, 466–475. https://doi.org/10.1016/j.cities.2010.08.001.
Knapp, C., Stuart, E., Kofinas, G., Fresco, N., Carothers, C., Craver, A., 2014. Parks, people, and change: The importance of multistakeholder engagement in adaptation planning for conserved areas. Ecol. Soc. 19, 1–16. https://doi.org/10.5751/ES-06906-190416.
Kotzee, I., Reyers, B., 2016. Piloting a social-ecological index for measuring flood resilience: A composite index approach. Ecol. Indicat. 60, 45–53. https://doi.org/10.1016/j.ecolind.2015.06.018.
Kuruppu, N., Liverman, D., 2011. Mental preparation for climate adaptation: The role of cognition and culture in enhancing adaptive capacity of water management in Kiribati. Glob. Environ. Chang. 21, 657–669. https://doi.org/10.1016/j.gloenvcha.2010.12.002.
Lambeth, T., 2016. Coastal Louisiana: Adaptive Capacity in the Face of Climate Change. University of New Orleans.
Lan, Y., Hsu, T., Lin, Y., Huang, C., 2013. An Adaptation Due to Climate Change in Southwest Coast of Taiwan. Coast. Manag. 41, 172–189. https://doi.org/10.1080/08920753.2013.768514.
Larsen, P.H., Goldsmith, S., Smith, O., Wilson, M.L., Strzepek, K., Chinowsky, P., Saylor, B., 2008. Estimating future costs for Alaska public infrastructure at risk from climate change. Glob. Environ. Chang. 18, 442–457. https://doi.org/10.1016/j.gloenvcha.2008.03.005.
Larson, S., Alexander, K.S., Djalante, R., Kirono, D.G.C., 2013. The Added Value of Understanding Informal Social Networks in an Adaptive Capacity Assessment: Explorations of an Urban Water Management System in Indonesia. Water Resour. Manag. 27, 4425–4441. https://doi.org/10.1007/s11269-013-0412-2.
Lazarus, N., 2016. A County-Level Risk Assessment of the Deep Water Horizon Oil Spill in the Gulf of Mexico. Geogr. Rev. 106, 360–380. https://doi.org/10.1111/j.1931-0846.2016.12178.x.
Lebel, L., 2013. Local knowledge and adaptation to climate change in natural resource-based societies of the Asia-Pacific. Mitig. Adapt. Strategies Glob. Change 18, 1057–1076. https://doi.org/10.1007/s11027-012-9407-1.
Ledee, E., Sutton, S., Tobin, R., De Freitas, D., 2012. Responses and adaptation strategies of commercial and charter fishers to zoning changes in the Great Barrier Reef Marine Park. Mar. Pol. 36, 226–234. https://doi.org/10.1016/j.marpol.2011.05.009.
Lemieux, C., Scott, D., 2011. Changing climate, challenging choices: Identifying and evaluating climate change adaptation options for protected areas management in Ontario, Canada. Environ. Manag. 48, 675–690. https://doi.org/10.1007/s00267-011-9700-x.
Levin, S., Xepapadeas, T., Crépin, A.S., Norberg, J., De Zeeuw, A., Folke, C., Hughes, T., Arrow, K., Barrett, S., Daily, G., Ehrlich, P., Kautsky, N., Mäler, K.G., Polasky, S., Troell, M., Vincent, J.R., Walker, B., 2013. Social-ecological systems as complex adaptive systems: Modeling and policy implications. Environ. Dev. Econ. 18, 111–132. https://doi.org/10.1017/S1355770X12000460.
Levine, A., Richmond, L., 2014. Examining enabling conditions for community-based fisheries comanagement: Comparing efforts in hawai'i and American Samoa. Ecol. Soc. 19, 24. https://doi.org/10.5751/ES-06191-190124.
Lewis, J., 2013. Some realities of resilience: an updated case study of storms and flooding at Chiswell, Dorset. Disaster Prev. Manag. 22, 300–311. https://doi.org/10.1108/dpm-03-2013-0053.
Li, Y., Degener, J., Gaudreau, M., Li, Y., Kappas, M., 2016. Adaptive capacity based water quality resilience transformation and policy implications in rapidly urbanizing

landscapes. Sci. Total Environ. 569 (570), 168–178. https://doi.org/10.1016/j.scitotenv.2016.06.110.
Linnekamp, F., Koedam, A., Baud, I.S.A., 2011. Household vulnerability to climate change: Examining perceptions of households of flood risks in Georgetown and Paramaribo. Habitat Int. 35, 447–456. https://doi.org/10.1016/j.habitatint.2010.12.003.
Lins-de-Barros, F., 2017. Integrated coastal vulnerability assessment: A methodology for coastal cities management integrating socioeconomic, physical and environmental dimensions - Case study of Região dos Lagos, Rio de Janeiro, Brazil. Ocean Coast Manag. 149, 1–11. https://doi.org/10.1016/j.ocecoaman.2017.09.007.
Littles, C.J., Jackson, C.A., DeWitt, T.H., Harwell, M.C., 2018. Linking people to coastal habitats: A meta-analysis of final ecosystem goods and services on the coast. Ocean Coast Manag. 165, 356–369. https://doi.org/10.1016/j.ocecoaman.2018.09.009.
Lloyd, M.G., Peel, D., Duck, R.W., 2013. Towards a social-ecological resilience framework for coastal planning. Land Use Pol. 30, 925–933. https://doi.org/10.1016/j.landusepol.2012.06.012.
Lohmann, H., 2016. Comparing vulnerability and adaptive capacity to climate change in individuals of coastal Dominican Republic. Ocean Coast Manag. 132, 111–119. https://doi.org/10.1016/j.ocecoaman.2016.08.009.
López-Angarita, J., Moreno-Sánchez, R., Maldonado, J., Sánchez, J., 2014. Evaluating linked social-ecological systems in marine protected areas. Conserv. Lett. 7, 241–252. https://doi.org/10.1111/conl.12063.
Lopoukhine, N., Crawhall, N., Dudley, N., Figgis, P., Karibuhoye, C., Laffoley, D., Miranda, L., LacKinnon, K., Sandwith, T., 2012. Protected areas: providing natural solutions to 21st Century challenges. Sapiens 5, 117–131. https://doi.org/10.1017/CBO9781107415324.004.
Lyth, A., Baldwin, C., Davison, A., Fidelman, P., Booth, K., Osborne, C., 2017. Valuing third sector sustainability organisations–qualitative contributions to systemic social transformation. Local Environ. 22, 1–21. https://doi.org/10.1080/13549839.2016.1149457.
MacCord, P.L., Begossi, A., 2006. Dietary changes over time in a Caicara community from the Brazilian Atlantic forest. Ecol. Soc. 11.
Maina, J., Kithiia, J., Cinner, J., Neale, E., Noble, S., Charles, D., Watson, J., 2016. Integrating social–ecological vulnerability assessments with climate forecasts to improve local climate adaptation planning for coral reef fisheries in Papua New Guinea. Reg. Environ. Change 16, 881–891. https://doi.org/10.1007/s10113-015-0807-0.
Maldonado, J., Moreno-Sánchez, P., 2014. Estimating the adaptive capacity of local communities at marine protected areas in Latin-America: A practical approach. Ecol. Soc. 19, 16.
Marshall, N., Marshall, P., Abdulla, A., Rouphael, T., 2010. The links between resource dependency and attitude of commercial fishers to coral reef conservation in the red sea. Ambio 39, 305–313. https://doi.org/10.1007/s13280-010-0065-9.
Martínez, C., Aránguiz, R., 2016. Riesgo de tsunami y planificación resiliente de la costa chilena: La localidad de Boca Sur, San Pedro de la Paz (37° S). Rev. Geogr. Norte Gd. 64, 33–54. https://doi.org/10.4067/S0718-34022016000200004.
McCay, B., Micheli, F., Ponce-Diaz, G., Murray, G., Shester, G., Ramirez-Sanchez, S., Weisman, W., 2014. Cooperatives, concessions, and co-management on the Pacific coast of Mexico. Mar. Pol. 44, 49–59. https://doi.org/10.1016/j.marpol.2013.08.001.
McClanahan, T.R., Cinner, J.E., Maina, J., Graham, N.A.J., Daw, T.M., Stead, S.M., Wamukota, A., Brown, K., Ateweberhan, M., Venus, V., C, P.N.V., 2008. Conservation action in a changing climate. Conserv. Lett. 1, 53–59. https://doi.org/10.1111/j.1755-263X.2008.00008_1.x.
McClenachan, L., O'Connor, G., Reynolds, T., 2015. Adaptive capacity of co-management systems in the face of environmental change: The soft-shell clam fishery and invasive green crabs in Maine. Mar. Pol. 52, 26–32. https://doi.org/10.1016/j.marpol.2014.10.023.
McFadden, L., Penning-Rowsell, E., Tapsell, S., 2009. Strategic coastal flood-risk management in practice: Actors' perspectives on the integration of flood risk management in London and the Thames Estuary. Ocean Coast Manag. 52, 636–645. https://doi.org/10.1016/j.ocecoaman.2009.10.001.
McNamara, K.E., Westoby, R., 2011. Local knowledge and climate change adaptation on Erub Island, Torres Strait. Local Environ. 16, 887–901. https://doi.org/10.1080/13549839.2011.615304.
McNamara, K., Westoby, R., Smithers, S., 2017. Identification of limits and barriers to climate change adaptation: case study of two islands in Torres Strait, Australia. Geogr. Res. 55, 438–455. https://doi.org/10.1111/1745-5871.12242.
Mehvar, S., Filatova, T., Dastgheib, A., de Ruyter van Steveninck, E., Ranasinghe, R., 2018. Quantifying Economic Value of Coastal Ecosystem Services: A Review. J. Mar. Sci. Eng. https://doi.org/10.3390/jmse6010005.
Mendoza, M.E.T., The, B.D., Naret, H., Ballaran Jr., V.G., Arias, J.K.B., 2014. Assessing Vulnerability to Climate Change Impacts in Cambodia, the Philippines and Vietnam: An Analysis at the Commune and Household Level. J. Environ. Sci. Manag. 17, 78–91.
Metcalf, S., Van Putten, E., Frusher, S., Marshall, N., Tull, M., Caputi, N., Haward, M., Hobday, A., Holbrook, N., Jennings, S., Pecl, G., Shaw, J., 2015. Measuring the vulnerability of marine social-ecological systems: a prerequisite for the identification of climate change adaptations. Ecol. Soc. 20, 35. https://doi.org/10.5751/ES-07509-200235.
Micheli, F., Saenz-Arroyo, A., Greenley, A., Vazquez, L., Espinoza Montes, J., Rossetto, M., de Leo, G., 2012. Evidence that marine reserves enhance resilience to climatic impacts. PLoS One 7, 8. https://doi.org/10.1371/journal.pone.0040832.
Millennium Ecosystem Assessment, 2005. Ecosystems and human well-being: Synthesis. Island Press, Washington DC. https://doi.org/10.1196/annals.1439.003.
Mohammed, K., Dash, G., Kumari, S., Sreenath, K., Makwana, N.P., Swatipriyanka, S., Ambrose, T.V., Shyam, S., Kripa, V., Zacharia, P.U., 2017. Vulnerability of Coastal Fisher Households to Climate Change: A Case Study from Gujarat, India. Turk. J. Fish. Aquat. Sci. 17, 193–203. https://doi.org/10.4194/1303-2712-v17_1_21.
Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., PRISMA Group, 2009. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med. 6, e1000097. https://doi.org/10.1371/journal.pmed.1000097.
Molua, E.L., 2012. Climate extremes, location vulnerability and private costs of property protection in Southwestern Cameroon. Mitig. Adapt. Strategies Glob. Change 17, 293–310. https://doi.org/10.1007/s11027-011-9326-6.
Moreno, A., Becken, S., 2009. A climate change vulnerability assessment methodology for coastal tourism. J. Sustain. Tourism 17, 473–488. https://doi.org/10.1080/09669580802651681.
Moreno-Sánchez, R., Maldonado, J., 2013. Adaptive capacity of fishing communities at marine protected areas: A case study from the colombian pacific. Ambio 42, 985–996. https://doi.org/10.1007/s13280-013-0454-y.
Morrison, C., Ramsey, E., Bond, D., 2017. The role of social entrepreneurs in developing community resilience in remote areas. J. Enterprising Communities People Places Glob. Econ. 11, 95–112. https://doi.org/10.1108/jec-02-2015-0020.
Mozumder, M., Wahab, M., Sarkki, S., Schneider, P., Islam, M., 2018. Enhancing Social Resilience of the Coastal Fishing Communities: A Case Study of Hilsa (Tenualosa Ilisha H.) Fishery in Bangladesh. Sustainability 10, 21. https://doi.org/10.3390/su10103501.
Müller, C., Waha, K., Bondeau, A., Heinke, J., 2014. Hotspots of climate change impacts in sub-Saharan Africa and implications for adaptation and development. Glob. Chang. Biol. 20, 2505–2517. https://doi.org/10.1111/gcb.12586.
Mulrennan, M., 2014. On the edge: a consideration of the adaptive capacity of Indigenous Peoples in coastal zones from the Arctic to the Tropics. In: Martini, I.P., Wanless, H.R. (Eds.), Sedimentary Coastal Zones from High to Low Latitudes: Similarities and Differences. Geological Society Special Publication, pp. 79–102. https://doi.org/10.1144/sp388.21.
Mulrennan, M.E., Bussières, V., 2018. Social-ecological resilience in indigenous coastal edge contexts. Ecol. Soc. 23, 18. https://doi.org/10.5751/ES-10341-230318.
Murti, R., Buyck, C., 2014. In: Safe Havens: Protected Areas for Disaster Risk Reduction and Climate Change Adaptation. Safe Havens. Gland, Switzerland UICN.
Mustafa, D., 1998. Structural causes of vulnerability to flood hazard in Pakistan*. Econ. Geogr. 74, 289–305. https://doi.org/10.1111/j.1944-8287.1998.tb00117.x.
Mycoo, M., 2014. Sustainable tourism, climate change and sea level rise adaptation policies in Barbados. Nat. Resour. Forum 38, 47–57. https://doi.org/10.1111/1477-8947.12033.
Mycoo, M., 2015. Communicating climate change in rural coastal communities. Int. J. Clim. Chang. Strateg. Manag. 7, 58–75. https://doi.org/10.1108/ijccsm-04-2013-0042.
Narayanan, K., Sahu, S.K., 2016. Effects of climate change on household economy and adaptive responses among agricultural households in eastern coast of India. Curr. Sci. 110, 1240–1250. https://doi.org/10.18520/cs/v110/i7/1240-1250.
Nayak, P., Oliveira, L., Berkes, F., 2014. Resource degradation, marginalization, and poverty in small-scale fisheries: Threats to social-ecological resilience in India and Brazil. Ecol. Soc. 19. https://doi.org/10.5751/ES-06656-190273.
Nelson, D.R., 2011. Adaptation and resilience: Responding to a changing climate. Wiley Interdiscip. Rev. Clim. Chang. 2, 113–120. https://doi.org/10.1002/wcc.91.
Nelson, D.R., Adger, W.N., Brown, K., 2007. Adaptation to environmental change: contributions of a resilience framework. Annu. Rev. Environ. Resour. 32, 395–419. https://doi.org/10.1146/annurev.energy.32.051807.090348.
Nenadović, M., Basurto, X., Weaver, A.H., 2016. Contribution of subsidies and participatory governance to fishers' adaptive capacity. J. Environ. Dev. 25, 426–454. https://doi.org/10.1177/1070496516670448.
Nguyen, A.L., Truong, M.H., Verreth, J.A.J., Leemans, R., Bosma, R.H., De Silva, S.S., 2015. Exploring the climate change concerns of striped catfish producers in the Mekong Delta, Vietnam. SpringerPlus 4, 1–8. https://doi.org/10.1186/s40064-015-0822-0.
Nhuan, M.T., Tue, N.T., Hue, N.T.H., Quy, T.D., Lieu, T.M., 2016. An indicator-based approach to quantifying the adaptive capacity of urban households: The case of Da Nang city, Central Vietnam. Urban Clim. 15, 60–69. https://doi.org/10.1016/j.uclim.2016.01.002.
Norris, F., Stevens, S., Pfefferbaum, B., Wyche, K., Pfefferbaum, R., Norris, F.H., Stevens, S.P., Pfefferbaum, B., Wyche, K.F., Pfefferbaum, R.L., 2008. Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. Am. J. Community Psychol. 41, 127–150. https://doi.org/10.1007/s10464-007-9156-6.
Novak, V., Fernandez-Anez, N., Loichiro, A., 2017. Rethinking resilience planning: From problemas to potential. Int. J. Disaster Resil. Built Environ. 6, 102–116. https://doi.org/10.1108/IJDRBE-06-2012-0019.
Nursey-Bray, M., Blackwell, B., Brooks, B., Campbell, M., Goldsworthy, L., Pateman, H., Rodrigues, I., Roome, M., Wright, J., Francis, J., Hewitt, C., 2013. Vulnerabilities and adaptation of ports to climate change. J. Environ. Plann. Manag. 56, 1021–1045. https://doi.org/10.1080/09640568.2012.716363.
O'Hare, G., 2002. Climate change and the temple of sustainable development. Geography 87, 234–246. https://doi.org/10.2307/40573739.
Oceana, 2011. Areas marinas protegidas: una herramienta para combatir la sobrepesca y conservar los ecosistemas marinos.
Oldekop, J.A., Holmes, G., Harris, W.E., Evans, K.L., 2016. A global assessment of the social and conservation outcomes of protected areas. Conserv. Biol. 30, 133–141. https://doi.org/10.1111/cobi.12568.
Orchard, S., Stringer, L.C., Quinn, C.H., 2015. Impacts of aquaculture on social networks in the mangrove systems of northern Vietnam. Ocean Coast Manag. 114, 1–10. https://doi.org/10.1016/j.ocecoaman.2015.05.019.
Ostrom, E., 2009. A general framework for analyzing sustainability of social-ecological systems. Science 325, 419–422. https://doi.org/10.1126/science.1172133.
Park, J., Kang, M.S., Song, I., 2015. Assessment of Flood Vulnerability Based on CMIP5

Climate Projections in South Korea. J. Am. Water Resour. Assoc. 51, 859–876. https://doi.org/10.1111/jawr.12283.
Paterson, S.K., Felling, M., Nunes, L.H., Moreira, F. de A., Guida, K., Marengo, J.A., 2017. Size does matter: City scale and the asymmetries of climate change adaptation in three coastal towns. Geoforum 81, 109–119. https://doi.org/10.1016/j.geoforum.2017.02.014.
Pereira, L.F.M., Barreto, S., Pittock, J., 2009. Participatory river basin management in the São João River, Brazil: A basis for climate change adaptation? Clim. Dev. 1, 261–268. https://doi.org/10.3763/cdev.2009.0026.
Peria, S., Pulhin, J., Tapia, M., Pedro, C., Peras, R., Evangelista, R., Lasco, R., Pulhin, F., 2016. Knowledge, Risk Attitudes and Perceptions on Extreme Weather Events of Smallholder Farmers in Ligao City, Albay, Bicol, Philippines. J. Environ. Sci. Manag. 31–41.
Petheram, L., Stacey, N., Fleming, A., 2015. Future sea changes: Indigenous women's preferences for adaptation to climate change on South Goulburn Island, Northern Territory (Australia). Clim. Dev. 7, 339–352. https://doi.org/10.1080/17565529.2014.951019.
Pinkus-Rendón, M.J., Ávila-lópez, C.M., Matson, M.V.C., Ortega-rubio, A., 2018. Mexican natural resources management and biodiversity conservation. In: Mexican Natural Resources Management and Biodiversity Conservation, pp. 555–572. https://doi.org/10.1007/978-3-319-90584-6.
Pitchon, A., 2011. Sea Hunters or Sea Farmers? Transitions in Chilean Fisheries. Hum. Organ. 70, 200–209. https://doi.org/10.17730/humo.70.2.q66v20403172hh3t.
Piya, L., Joshi, N.P., Maharjan, K.L., 2016. Vulnerability of Chepang households to climate change and extremes in the Mid-Hills of Nepal. Clim. Change 135, 521–537. https://doi.org/10.1007/s10584-015-1572-2.
Portman, M., 2018. Policy Options for Coastal Protection: Integrating Inland Water Management with Coastal Management for Greater Community Resilience. J. Water Resour. Plann. Manag. 144, 11. https://doi.org/10.1061/(asce)wr.1943-5452.0000913.
Potts, T., Burdon, D., Jackson, E., Atkins, J., Saunders, J., Hastings, E., Langmead, O., 2013. Do marine protected areas deliver flows of ecosystem services to support human welfare? Mar. Pol. 1–10. https://doi.org/10.1016/j.marpol.2013.08.011.
Preston, B.L., Brooke, C., Measham, T.G., Smith, T.F., Gorddard, R., 2009. Igniting change in local government: Lessons learned from a bushfire vulnerability assessment. Mitig. Adapt. Strategies Glob. Change 14, 251–283. https://doi.org/10.1007/s11027-008-9163-4.
Pruneau, D., Kerry, J., Blain, S., Evichnevetski, E., Deguire, P., Barbier, P.Y., Freiman, V., Therrien, J., Langis, J., Lang, M., 2013. Competencies demonstrated by municipal employees during adaptation to climate change: A pilot study. J. Environ. Educ. 44, 217–231. https://doi.org/10.1080/00958964.2012.759521.
Rabbani, G., Rahman, S.H., Faulkner, L., 2013. Impacts of climatic hazards on the small wetland ecosystems (ponds): Evidence from some selected areas of coastal Bangladesh. Sustainability 5, 1510–1521. https://doi.org/10.3390/su5041510.
Rahman, M.K., Paul, B.K., Curtis, A., Schmidlin, T., 2015. Linking Coastal Disasters and Migration: A Case Study of Kutubdia Island, Bangladesh. Prof. Geogr. 2, 218–228. https://doi.org/10.1115/SBC2009-205382.
Ramenzoni, V.C., Yoskowitz, D., 2017. Systematic Review of Recent Social Indicator Efforts in US Coastal and Ocean Ecosystems (2000-2016). Environ. Soc. 8, 9–39. https://doi.org/10.3167/ares.2017.080102.
Ramirez-Sanchez, S., Pinkerton, E., 2009. The Impact of Resource Scarcity on Bonding and Bridging Social Capital: the Case of Fishers' Information-Sharing Networks in Loreto, BCS, Mexico. Ecol. Soc. 14.
Rasheed, A.R., Abdulla, A., Zakariyya, N.I., 2016. Vulnerability of different types of fishers to potential implementation of a management plan in a Marine Protected Area (MPA) in the Maldives. Mar. Pol. 74, 195–204. https://doi.org/10.1016/j.marpol.2016.09.029.
Ratner, B.D., Cohen, P., Barman, B., Mam, K., Nagoli, J., Allison, E.H., 2013. Governance of aquatic agricultural systems: analyzing representation, power, and accountability. Ecol. Soc. 18. https://doi.org/10.5751/es-06043-180459.
Razafindrabe, B.H.N., Kada, R., Arima, M., Inoue, S., 2014. Analyzing flood risk and related impacts to urban communities in central Vietnam. Mitig. Adapt. Strategies Glob. Change 19, 177–198. https://doi.org/10.1007/s11027-012-9433-z.
Richards, R.G., Sanò, M., Sahin, O., 2016. Exploring climate change adaptive capacity of surf life saving in Australia using Bayesian belief networks. Ocean Coast Manag. 120, 148–159. https://doi.org/10.1016/j.ocecoaman.2015.11.007.
Rivera, A., Gelcich, S., García-Florez, L., Alcázar, J.L., Acuña, J.L., 2014. Co-management in Europe: Insights from the gooseneck barnacle fishery in Asturias, Spain. Mar. Pol. 50, 300–308. https://doi.org/10.1016/j.marpol.2014.07.011.
Roberts, C., O'Leary, B., McCauley, D., Cury, P.M., Duarte, C., Lubchenco, J., Pauly, D., Sáenz-Arroyo, A., Sumaila, R., Wilson, R., Worm, B., Castilla, J., 2017. Marine reserves can mitigate and promote adaptation to climate change. Proc. Natl. Acad. Sci. U. S. A. 114, 9. https://doi.org/10.1073/pnas.1701262114.
Ross, A.D., 2016. Perceptions of Resilience Among Coastal Emergency Managers. Risk, Hazards Cris. Publ. Pol. 7, 4–24. https://doi.org/10.1002/rhc3.12092.
Sales, R.F., 2009. Vulnerability and adaptation of coastal communities to climate variability and sea-level rise: Their implications for integrated coastal management in Cavite City, Philippines. Ocean Coast Manag. 52, 395–404. https://doi.org/10.1016/j.ocecoaman.2009.04.007.
Salik, K., Jahangir, S., Zafar Zahdi, W., Ul Hasson, S., 2015. Climate change vulnerability and adaptation options for the coastal communities of Pakistan. Ocean Coast Manag. 112, 61–73. https://doi.org/10.1016/j.ocecoaman.2015.05.006.
Sandanam, A., Diedrich, A., Gurney, G.G., Richardson, T.D., 2018. Perceptions of cyclone preparedness: Assessing the role of individual adaptive capacity and social capital in the Wet Tropics, Australia. Sustain 10, 1165. https://doi.org/10.3390/su10041165.
Saroar, M., Routray, J., 2012. Impacts of climatic disasters in coastal Bangladesh: Why does private adaptive capacity differ? Reg. Environ. Change 12, 169–190. https://doi.org/10.1007/s10113-011-0247-4.
Sausner, E., Webster, N., 2016. Migration and Community Resilience in Nicaraguan Afro-Caribbean Coastal Communities. J. Dev. Soc. 32, 484–507. https://doi.org/10.1177/0169796x16667876.
Savolainen, M.A., Kazmierczak, R.F., Caffey, R.H., 2015. Resiliency of the Coastal Recreational For-Hire Fishing Industry to Natural Disasters. Estuar. Coasts 38, 114–123. https://doi.org/10.1007/s12237-013-9648-6.
Sayles, J.S., Mulrennan, M.E., 2010. Securing a Future: Cree Hunters' Resistance and Flexibility to Environmental Changes, Wemindji, James Bay. Ecol. Soc. 15.
Schwarz, A., Béné, C., Bennett, G., Boso, D., Hilly, Z., Paul, C., Posala, R., Sibiti, S., Andrew, N., 2011. Vulnerability and resilience of remote rural communities to shocks and global changes: Empirical analysis from Solomon Islands. Glob. Environ. Chang. 21, 1128–1140. https://doi.org/10.1016/j.gloenvcha.2011.04.011.
Scott, D., Simpson, M.C., Sim, R., 2012. The vulnerability of Caribbean coastal tourism to scenarios of climate change related sea level rise. J. Sustain. Tourism 20, 883–898. https://doi.org/10.1080/09669582.2012.699063.
Serrao-Neumann, S., Di Giulio, G.M., Ferreira, L.C., Choy, D.L., 2013. Climate change adaptation: Is there a role for intervention research? Futures 53, 86–97. https://doi.org/10.1016/j.futures.2013.08.002.
Sharma, U., Patwardhan, A., 2008. An empirical approach to assessing generic adaptive capacity to tropical cyclone risk in coastal districts of India. Mitig. Adapt. Strategies Glob. Change 13, 819–831. https://doi.org/10.1007/s11027-008-9143-8.
Sharma, U., Patwardhan, A., Patt, A.G., 2013. Education as a Determinant of Response to Cyclone Warnings: Evidence from Coastal Zones in India. Ecol. Soc. 18. https://doi.org/10.5751/es-05439-180218.
Sherly, M., Karmakar, S., Parthasarathy, D., Chan, T., Rau, C., 2015. Disaster Vulnerability Mapping for a Densely Populated Coastal Urban Area: An Application to Mumbai, India. Ann. Assoc. Am. Geogr. 105, 1198–1220. https://doi.org/10.1080/00045608.2015.1072792.
Sherrieb, K., Louis, C.A., Pfefferbaum, R.L., Pfefferbaum, B.J.D., Diab, E., Norris, F.H., 2012. Assessing community resilience on the US coast using school principals as key informants. Int. J. Disaster Risk Reduct. 2, 6–15. https://doi.org/10.1016/j.ijdrr.2012.06.001.
Singh-Peterson, L., Underhill, S.J., 2017. A multi-scalar, mixed methods framework for assessing rural communities' capacity for resilience, adaptation, and transformation. Community Dev. 48, 124–140. https://doi.org/10.1080/15575330.2016.1250103.
Smallegan, S.M., Irish, J.L., Den Bieman, J.P., 2016. Morphological response of a sandy barrier island with a buried seawall during Hurricane Sandy. Coast. Eng. 110, 102–110. https://doi.org/10.1016/j.coastaleng.2016.01.005.
Smit, B., Pilifosova, O., 2003. Adaptation to Climate Change in the Context of Sustainable Development and Equity, Working Group II: Impacts, Adaptation and Vulnerability.
Smit, B., Wandel, J., 2006. Adaptation, adaptive capacity and vulnerability. Glob. Environ. Chang. 16, 282–292. https://doi.org/10.1016/j.gloenvcha.2006.03.008.
Smith, L.C., Frankenberger, T.R., 2018. Does resilience capacity reduce the negative impact of shocks on household food security? Evidence from the 2014 floods in Northern Bangladesh. World Dev. 102, 358–376. https://doi.org/10.1016/j.worlddev.2017.07.003.
Smith, J.W., Anderson, D.H., Moore, R.L., 2012. Social Capital, Place Meanings, and Perceived Resilience to Climate Change. Rural Sociol. 77, 380–407. https://doi.org/10.1111/j.1549-0831.2012.00082.x.
Smith, T.F., Thomsen, D.C., Gould, S., Schmitt, K., Schlegel, B., 2013. Cumulative Pressures on Sustainable Livelihoods: Coastal Adaptation in the Mekong Delta. Sustainability 5, 228–241. https://doi.org/10.3390/su5010228.
Solecki, W., Pelling, M., Garschagen, M., 2017. Transitions between risk management regimes in cities. Ecol. Soc. 22. https://doi.org/10.5751/es-09102-220238.
Sovacool, B.K., 2012. Perceptions of climate change risks and resilient island planning in the Maldives. Mitig. Adapt. Strategies Glob. Change 17, 731–752. https://doi.org/10.1007/s11027-011-9341-7.
Steenbergen, D.J., Marlessy, C., Holle, E., 2017. Effects of rapid livelihood transitions: Examining local co-developed change following a seaweed farming boom. Mar. Pol. 82, 216–223. https://doi.org/10.1016/j.marpol.2017.03.026.
Stoffle, R., Minnis, J., 2007. Marine protected areas and the coral reefs of traditional settlements in the Exumas, Bahamas. Coral Reefs 26, 1023–1032. https://doi.org/10.1007/s00338-007-0264-4.
Storbjörk, S., Hedrén, J., 2011. Institutional capacity-building for targeting sea-level rise in the climate adaptation of Swedish coastal zone management. Lessons from Coastby. Ocean Coast Manag. 54, 265–273. https://doi.org/10.1016/j.ocecoaman.2010.12.007.
Su, S., Pi, J., Wan, C., Li, H., Xiao, R., Li, B., 2015. Categorizing social vulnerability patterns in Chinese coastal cities. Ocean Coast Manag. 116, 1–8. https://doi.org/10.1016/j.ocecoaman.2015.06.026.
Takasaki, Y., 2016. Learning from disaster: community-based marine protected areas in Fiji. Environ. Dev. Econ. 21, 53–77. https://doi.org/10.1017/S1355770X15000108.
Tapsuwan, S., Rongrongmuang, W., 2015. Climate change perception of the dive tourism industry in Koh Tao island, Thailand. J. Outdoor Recreat. Tour. 11, 58–63. https://doi.org/10.1016/j.jort.2015.06.005.
Teng, S., Lee, M., Hsu, J., Lin, T., Lin, Y., Chang, Y., 2016. Assessing the vulnerability of fishery villages influenced by climate change and anthropogenic activity in the acoastal zone of the Tamsui river. J. Mar. Sci. Technol. 24, 1115–1126. https://doi.org/10.6119/jmst-016-1205-1.
Teschner, N., McDonald, A., Foxon, T., Paavola, J., 2012. Integrated transitions toward sustainability: The case of water and energy policies in Israel. Technol. Forecast. Soc. Change 79, 457–468. https://doi.org/10.1016/j.techfore.2011.08.013.
Thathsarani, U.S., Gunaratne, L.H.P., 2018. Constructing and Index to Measure the Adaptive Capacity to Climate Change in Sri Lanka. Proc. Eng. 212, 278–285. https://

doi.org/10.1016/j.proeng.2018.01.036.
Thomalla, F., Larsen, R.K., 2010. Resilience in the context of tsunami early warning systems and community disaster preparedness in the indian ocean region. Environ. Hazards 9, 249–265. https://doi.org/10.3763/ehaz.2010.0051.
Tiller, R., Richards, R., 2015. Once bitten, twice shy: Aquaculture, stakeholder adaptive capacity, and policy implications of iterative stakeholder workshops; the case of Frøya, Norway. Ocean Coast Manag. 118, 98–109. https://doi.org/10.1016/j.ocecoaman.2015.09.001.
Tiller, R., Mork, J., Richards, R., Eisenhauer, L., Liu, Y., Nakken, J., Borgersen, Å., 2014. Something fishy: Assessing stakeholder resilience to increasing jellyfish (Periphylla periphylla) in Trondheimsfjord, Norway. Mar. Pol. 46, 72–83. https://doi.org/10.1016/j.marpol.2013.12.006.
Tolentino-Arévalo, O., Markantoni, M., Espinoza-Tenorio, A., Mesa-Jurado, M.A., 2018. Drivers of adaptive capacity to climate change in coastal fishing communities of Tabasco, Mexico. In: Viability and Sustainability of Small-Scale Fisheries in Latin America and The Caribbean, pp. 125–147. https://doi.org/10.1007/978-3-319-76078-0_6.
Tompkins, E.L., Lemos, M.C., Boyd, E., 2008. A less disastrous disaster: Managing response to climate-driven hazards in the Cayman Islands and NE Brazil. Glob. Environ. Chang. Policy Dimens. 18, 736–745. https://doi.org/10.1016/j.gloenvcha.2008.07.010.
Torre-Castro, M., Ronnback, P., 2004. Links between humans and seagrasses — an example from tropical East Africa. Ocean Coast Manag. 47, 361–387. https://doi.org/10.1016/j.ocecoaman.2004.07.005.
Torres, H.R., Alsharif, K.A., Tobin, G.A., 2018. Perspectives on adaptive capacity to climate change in hazardous environments: Insights from broward County, Florida. Weather Clim. Soc. 10, 361–372. https://doi.org/10.1175/WCAS-D-17-0094.1.
Toseroni, F., Romagnoli, F., Marincioni, F., 2016. Adapting and reacting to measure an extreme event: a methodology to measure disaster community resilience. Energy Proc. 95, 491–498. https://doi.org/10.1016/j.egypro.2016.09.074.
Tran, H., Nguyen, Q., Kervyn, M., 2017. Household social vulnerability to natural hazards in the coastal Tran Van Thoi District, Ca Mau Province, Mekong Delta, Vietnam. J. Coast Conserv. 21, 489–503. https://doi.org/10.1007/s11852-017-0522-8.
Tull, M., Metcalf, S.J., Gray, H., 2016. The economic and social impacts of environmental change on fishing towns and coastal communities: A historical case study of Geraldton, Western Australia. ICES J. Mar. Sci. 73, 1437–1446. https://doi.org/10.1093/icesjms/fsv196.
Turner, B.L., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Hovelsrud-Broda, G.K., Kasperson, J.X., Kasperson, R.E., Luers, A., Martello, M.L., Mathiesen, S., Naylor, R., Polsky, C., Pulsipher, A., Schiller, A., Selin, H., Tyler, N., 2003. Illustrating the coupled human-environment system for vulnerability analysis: Three case studies. Proc. Natl. Acad. Sci. U. S. A. 100, 8080–8085. https://doi.org/10.1073/pnas.1231334100.
Ung, M., Luginaah, I., Chuenpagdee, R., Campbell, G., 2016. Perceived Self-Efficacy and Adaptation to Climate Change in Coastal Cambodia. Climate 4. https://doi.org/10.3390/cli4010001.
Uribe Botero, E., 2015. El Cambio climático y sus efectos en la biodiversidad en América Latina.
Uy, N., Takeuchi, Y., Shaw, R., 2011. Local adaptation for livelihood resilience in Albay, Philippines. Environ. Hazard Human Pol. Dimens. 10, 139–153. https://doi.org/10.1080/17477891.2011.579338.
Van den Brink, M., Meijerink, S., Termeer, C., Gupta, J., 2014. Climate-proof planning for flood-prone areas: Assessing the adaptive capacity of planning institutions in the Netherlands. Reg. Environ. Change 14, 981–995. https://doi.org/10.1007/s10113-012-0401-7.
Van Zandt, S., Gillis, W., Henry, W., Grover, H., Highfield, W., Brody, S., 2012. Mapping social vulnerability to enhance housing and neighborhood resilience. Hous. Pol. Debate 22, 29–55. https://doi.org/10.1080/10511482.2011.624528.
Vasey-Ellis, N., 2009. Planning for Climate Change in Coastal Victoria Planning for Climate Change in Coastal. Urban Pol. Res. 37–41. https://doi.org/10.1080/08111140902950487.
Villagra, P., Herrmann, G., Quintana, C., Sepulveda, R., 2016. Resilience thinking and urban planning in a coastal environment at risks of tsunamis: the case study of Mehuin, Chile. Rev. Geogr. Norte Gd. 82, 63–82.
Villalobos, I., 2000. Áreas Naturales Protegidas: instrumento estratégico para la conservacion de la biodiversidad. Gac. ecológica 24–34.
Vyas, S., Kumaranayake, L., 2006. Constructing socio-economic status indices: How to use principal components analysis. Health Policy Plan. 21, 459–468. https://doi.org/10.1093/heapol/czl029.
Waite, R., Burke, L., Gray, E., Beukering, P., Brander, L., Mckenzie, E., Pendleton, L., Schuhmann, P., Tompkins, E., 2014. Coastal capital: Ecosystem Valuation for Decision Making in the Caribbean.
Walker, B., Holling, C.S., Carpenter, S.R., Kinzig, A., 2004. Resilience, Adaptability and Transformability in Social – ecological Systems. Ecol. Soc. 9, 5. https://doi.org/10.1103/PhysRevLett.95.258101.
Wang, J., Huang, X., Zhong, T., Chen, Z., 2013. Climate change impacts and adaptation for saline agriculture in north Jiangsu Province, China. Environ. Sci. Policy 25, 83–93. https://doi.org/10.1016/j.envsci.2012.07.011.
Warrick, O., Aalbersberg, W., Dumaru, P., McNaught, R., Teperman, K., 2017. The 'Pacific Adaptive Capacity Analysis Framework': guiding the assessment of adaptive capacity in Pacific island communities. Reg. Environ. Change 17, 1039–1051. https://doi.org/10.1007/s10113-016-1036-x.
Wenzel, L., Gass, J., D'Iorio, M., Blackburn, J., 2013. A national perspective on the role of marine protected areas in sustaining fisheries. Fish. Res. 144, 23–27. https://doi.org/10.1016/j.fishres.2012.09.002.
West, J.J., Hovelsrud, G.K., 2010. Cross-scale Adaptation Challenges in the Coastal Fisheries: Findings from Lebesby, Northern Norway. Arctic 63, 338–354.
Wood, N., Good, J., 2004. Vulnerability of port and harbor communities to earthquake and tsunami hazards: The use of GIS in community hazard planning. Coast. Manag. 32, 243–269. https://doi.org/10.1080/08920750490448622.
Wrathall, D.J., Bury, J., Carey, M., Mark, B., McKenzie, J., Young, K., Baraer, M., French, A., Rampini, C., 2014. Migration Amidst Climate Rigidity Traps: Resource Politics and Social-Ecological Possibilism in Honduras and Peru. Ann. Assoc. Am. Geogr. 104, 292–304. https://doi.org/10.1080/00045608.2013.873326.
Xiao, Y., Van Zandt, S., 2012. Building community resiliency: spatial links between household and business post-disaster return. Urban Stud. 49, 2523–2542. https://doi.org/10.1177/0042098011428178.
Yáñez-Arancibia, A., Day, J., 2004. The Gulf of Mexico: Towards an integration of coastal management with large marine ecosystem management. Ocean Coast Manag. 47, 537–563. https://doi.org/10.1016/j.ocecoaman.2004.12.001.
Yemawnade, A., Timothy, O., Ogundele, O., Adesanya, A., 2016. Adaptive capacity and coping response strategies to natural disasters: A study in Nigeria. Int. J. Disaster Risk Reduct. 15, 132–147. https://doi.org/10.1016/j.ijdrr.2016.01.007.
Yohe, G., Tol, R., 2002. Indicators for social and economic coping capacity - Moving toward a working definition of adaptive capacity. Glob. Environ. Chang. 12, 25–40. https://doi.org/10.1016/S0959-3780(01)00026-7.
Yoo, G., Park, S., Chung, D., Kang, H., Hwang, J., 2010. Development and application of a methodology for vulnerability assessment of climate change in coastal cities. J. Environ. Pol. 9, 185–205. https://doi.org/10.1016/j.ocecoaman.2011.04.001.
Yoo, G., Park, S., Dong, K., Jeong Kang, H., Hwan, J., 2011. Development and application of a methodology for vulnerability assessment of climate change in coastal cities. Ocean Coast Manag. J. 54, 524–534. https://doi.org/10.1016/j.ocecoaman.2011.04.001.
Yoo, G., Kim, A.R., Hadi, S., 2014. A methodology to assess environmental vulnerability in a coastal city: Application to Jakarta, Indonesia. Ocean Coast Manag. 102, 169–177. https://doi.org/10.1016/j.ocecoaman.2014.09.018.
Yuan, X., Wang, Q., Wang, K., Wang, B., Jin, J., Wei, Y., 2015. China's regional vulnerability to drought and its mitigation strategies under climate change: data envelopment analysis and analytic hierarchy process integrated approach. Mitig. Adapt. Strategies Glob. Change 20, 341–359. https://doi.org/10.1007/s11027-013-9494-7.
Zafra-Calvo, N., Pascual, U., Brockington, D., Coolsaet, B., Cortes-Vazquez, J.A., Gross-Camp, N., Palomo, I., Burgess, N.D., 2017. Towards an indicator system to assess equitable management in protected areas. Biol. Conserv. 211, 134–141. https://doi.org/10.1016/j.biocon.2017.05.014.
Zhang, T., Bakar, S., 2017. The Implications of Local Perceptions, Knowledge, and Adaptive Strategies for Adaptation Planning in Coastal Communities of Zanzibar. Environ. Justice 10, 112–118. https://doi.org/10.1089/env.2016.0031.